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# Factors Affecting the Reliability of Physical Ability and Effort Ratings of Navy Tasks

Deborah L. Gebhardt  
Margarette C. Jennings  
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PHYSICAL ABILITY AND EFFORT RATINGS  
OF NAVY TASKS

Deborah L. Gebhardt  
Margarette C. Jennings  
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TECHNICAL REPORT

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# ABSTRACT

The study was carried out in order to compare and evaluate the utility and reliability of an index of perceived physical effort for use in the rating of Navy tasks by three different rater groups. Tasks with varying physical demands from four Navy jobs were rated by supervisors and incumbents within each job as well as by a group of job analysts. The rating scales include a perceived physical effort scale and ten physical ability scales. The results indicated that rated perceived effort was highly correlated with selected strength and stamina factors ( $r = .91$  to  $.95$ ). Further, all three rater groups were able to reliably use the index of perceived physical effort to discriminate between tasks with varying physical demands. These results suggest that ratings of physical effort by either job incumbents or supervisors are indicative of the ergonomic or metabolic costs of physical task performance. Further, such ratings can be used as a means to rank order large groups of jobs, and tasks within a job, according to their physical demands.

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## INTRODUCTION

Rated perceived effort (RPE) has been studied by psychologists, work physiologists, and ergonomists. This past research suggested that two factors influenced rated perceived effort. The first was termed a central factor and referred to the influence of such physiological parameters as heart rate, oxygen consumption, and pulmonary ventilation upon rated perceived effort (Borg & Noble, 1974; Cafarelli, 1977; Edwards, Melcher, Hesser, Wigertz, & Ekelund, 1972; Pandolf, 1977). There have been, however, studies that have disputed the importance of these central factors (Allen & Pandolf, 1977; Cafarelli & Noble, 1976), as well as those that proposed the existence of another factor. The second factor was called the local factor. It was found to influence RPE through the activity of the mechanoreceptors in tendons, ligaments, joints, and skin, differences in muscle tension, and sensitivity to metabolites (e.g., blood lactate) (Allen & Pandolf, 1977; Borg & Noble, 1974; Cain, 1973; Cain & Stevens, 1977).

In a recent study (Lollgen, Graham, & Sjogaard, 1980), both central and local factors were tested simultaneously. The authors suggested that rated perceived effort was a complex factor that was derived from both central and local factors. Several studies have also used differentiated ratings of perceived effort by asking the subject to rate specific kinds of effort, e.g., overall effort, arm effort, and leg effort (Gamberale, 1972). However, the overall effort rating correlated most highly with heart rate. These findings also pointed to the complexity of the effort rating.

Although controversy exists as to the exact factors underlying perceived effort, it can be stated that effort has been shown to differentiate between tasks with varying physiological and muscular demands (Hogan, Ogden, Gebhardt, & Fleishman, 1979; Myers, Gebhardt, & Fleishman, 1979; Borg, 1962; Borg & Dahlstrom, 1960; Borg & Linderholm, 1967; Cafarelli, 1977). For example, Stamford (1976) used a randomization of work load presentation and several modes of testing (i.e., bicycle

riding, treadmill walking and running, and bench stepping) to determine if the subjects were able to differentiate among work load intensities for a variety of test protocols. Correlations between heart rate and rated perceived effort ( $r = 0.74$  to  $0.90$ ) found in this study, suggested that the effort ratings did differentiate between work load intensities. Additionally, linear relationships have been found between rated perceived effort and oxygen consumption (Noble & Borg, 1972), and effort and blood lactate (Gamberale, 1972).

Since this past research has found rated perceived effort to be highly correlated with various physiological factors and to be a valid measure of differentiating between levels of physical exertion, it seems useful to examine the utility of such scales in classifying the physical demands of jobs or job tasks. This knowledge about job tasks would then be useful for assigning personnel to jobs that are appropriate to the individual's physical abilities. Previous studies in this program (Hogan & Fleishman, 1979; Hogan, Ogden, Gebhardt, & Fleishman, 1979, 1980) have demonstrated that such ratings are reliable and predictive of the physiological and ergonomic costs of performing job tasks.

The present study extends this work and was undertaken to evaluate whether Navy personnel who were presently or had previously been engaged in physically demanding jobs could reliably rate the amount of physical effort necessary to perform tasks that had low, moderate, and high levels of physical demand. Additionally, it was the purpose of the study to determine if supervisory and incumbent Navy personnel would agree upon the amount of physical effort needed to perform a task. A third rating group, job analysts, was introduced into the study to determine if individuals who were trained in work behaviors and human performance and who had no prior knowledge of Navy jobs could rate Navy tasks as well as experienced Navy personnel. The study bears on questions of the reliability and convergent validity of the index of physical effort developed, its feasibility for use by different types of raters, and its applicability to Navy jobs and tasks.

## PHASE I - METHODS AND PROCEDURES

The first step was the development of detailed information about the Navy jobs, which would serve as a basis for identifying the personnel requirements critical to job performance. Task level job information was developed through a series of research steps involving observations of actual behaviors, interviews with incumbents and training personnel, and review of task banks developed for all rates under evaluation. This qualitative information was later analyzed through quantitative rating procedures to indicate the critical physical requirements in each job.

### Preliminary Planning Meeting

In January 1980, the ARRO study team met with Navy Health Research Center (NHRC) staff in San Diego to discuss in detail the feasibility of the proposed methodology, to explore the availability of Navy staff, facilities, and other resources, and to develop alternative strategies to meet the practical requirements of the research. The staff visited the laboratories and training facilities, and met with some of the training specialists in order to select from among the Navy rates those jobs that would serve as the focus of the study. After consultation with Naval personnel (i.e., line officers, non-commissioned officers, and medical personnel), the rates of Boatswain's Mate (BM), Machinist's Mate (MM), Hull Maintenance Technician (HT), and Gunner's Mate (GM) were selected as representative of the most physically demanding rates.

### Task List Development

Preliminary task lists for each rate were prepared from resources including handbooks and manuals on topics relating to the rates selected, notes from the discussions and demonstrations conducted during the planning meeting, and an extensive review of the Navy Occupational Task Analysis Program Development (NOTAP) materials. The lists were revised and reorganized in order to provide uniformity of format. The tasks were clustered around activities such as Remove/Install and Inspect/Adjust, as they related to specific systems. Wherever possible, pertinent

information on the performance dimensions of worker behavior, tools, and work aids used was included.

Following the development of the preliminary task lists, ARRO developed a training program for use in briefing the NHRC staff on the data collection procedures (e.g., interview, observation). The training program included use of critical incident technique and use of interview forms and other materials. A second site visit was conducted during the period of March 3-10, 1980. The first morning was devoted to the job analysis interview training conducted by the ARRO staff for the two NHRC staff. During the afternoon, the team met with the Executive Officer at Fleet Training Center (FTC) and two FTC staff members who were involved in training personnel from each of the four rates. The FTC staff were briefed on the purpose of the study and a schedule for observations and interviews was developed. The ARRO and NHRC staffs spent the remainder of the week observing work in progress, handling tools and equipment, and interviewing supervisors (E6-E9) and incumbents (E2-E5) at FTC and aboard ship. The preliminary lists were clarified and amended following this procedure.

Following the initial observations and interviews, two Subject Matter Experts (SMEs) from each rate were convened for separate two-hour interviews to review and verify the task list information for completeness and accuracy. The results of these final meetings with the SMEs were incorporated into the development of the third and final set of task lists for each rate. This final set was then submitted to the SMEs for review.

The final task lists for each rate (i.e., BM, GM, HT, MM) consisted of major tasks and a number of subtasks representing the sequence of steps within the major task (e.g., Figure 1). The Gunner's Mate list had a total of 20 major tasks and 61 subtasks. The Boatswain's Mate list contained 38 major tasks and 128 subtasks. There were 23 major tasks and 120 subtasks on the Hull Technician's list, and 30 major tasks and 137 subtasks on the Machinist's Mate list. In addition, a list of four major tasks and 30 subtasks was prepared on Fire Fighting.

1. PMS on breech block (175#) 3" - 50 gun.
  - a. First GM crawls into appropriate area or places hand winching device in place.
  - b. Release pins and lower block onto chest with winch device.
  - c. Second GM reaches in and removes block from first GM.
  - d. Disassemble breech block, clean and repair.
  - e. Replace breech block by having second GM attach winch, lower block to first GM.
  - f. First GM cranks breech block, lifts block into place and sets the pins.
2. Release counter recoil spring on 3" - 50 gun.
  - a. Put release plate on end of gun barrel.
  - b. Attach cables, rods and bolts.
  - c. Turn screws equally to appropriate pressure to relieve counter recoil spring tension.
3. Remove loader driver motor for PMS.
  - a. Rig sling and unbolt motor (2 people).
  - b. Lift motor out of gun with chainfall.
  - c. Transport to work area.
  - d. Grease zirc fittings.
4. Check and make fine adjustments on 3" power drive.
5. Remove amplifier from train/elevation system.
  - a. Pull out rack.
  - b. Lift amplifier out of drawer.
  - c. Take to repair area.
6. Repair and adjust components of the control panels (e.g., circuit breakers, etc.).
7. Load 5" mortar with rapid blooming off-board chaff.
8. Load 3" - 50 gun during combat/gun shoot.
  - a. Second loader receives shell (40#) from magazine and places in rotary magazine.
  - b. First loader lifts shell out of rotary magazine and places and pushes into loader (projectile chamber).

FIGURE 1. SAMPLE OF GUNNER'S MATE (GM) TASKS AND SUBTASKS

To summarize, three successive drafts of the task lists were prepared incorporating information from different types of sources but relying on the many years of experience of the SMEs (Chief and Senior Chief) for guidance in the elucidation of task performance techniques aboard different classes of ships. Furthermore, no attempt was made to produce an exhaustive list of all tasks performed by the various rates. The primary aim was to identify those tasks with at least a moderate degree of physical demand but also to include some other "benchmark" tasks that would be representative of the range of physical demands. The intent throughout the job analysis was to ensure that the lists were accurate, concise, and clearly stated so that they would communicate uniformly about the tasks, and, thus, the demands of the job. A complete listing of the tasks is located in Appendix C.

#### Criticality Scale Development

This phase involved the determination of the "criticality" of the tasks identified. The job sample tasks within this study included critical work behaviors as part of the job analyses. These behaviors were evaluated by means of a quantitative scaling analysis. The concepts used to assess criticality included performance frequency, task requirements influencing personnel assignment, task importance, and physical effort in performance. These criticality scales consisted of a succinct definition and a 7-point rating scale. All discrete points on the scale were defined using behavioral anchors (Hogan, Jennings, Ogden, & Fleishman, 1980).

Criticality defined in terms of frequency emphasized the number of times a task was performed on the job per unit of time. This concept did not encompass the amount of time required to perform the task. The scale anchors for the Frequency Scale included time frames from "once in 1 - 2 years" to "several times an hour" (Figure 2). All tasks could be rated using these frequency dimensions.

The second scale, labeled Task Requirements, was designed to assess the flexibility with which personnel could be assigned to perform individual tasks (Hogan et al., 1980). The scale, presented in Figure 3, was

# FREQUENCY

RATE HOW OFTEN THE TASK IS PERFORMED ON THE JOB.  
THE AMOUNT OF TIME NECESSARY TO DO THE TASK IS NOT IMPORTANT HERE.

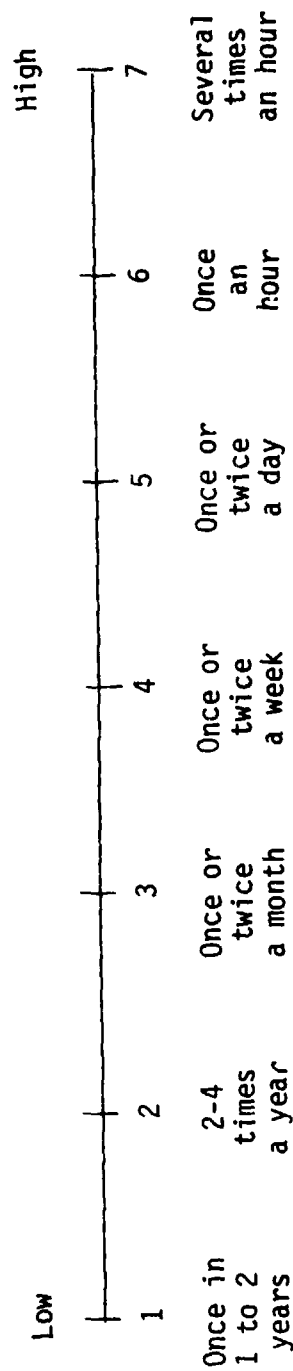


FIGURE 2. TASK PERFORMANCE FREQUENCY SCALE.



# TASK REQUIREMENTS

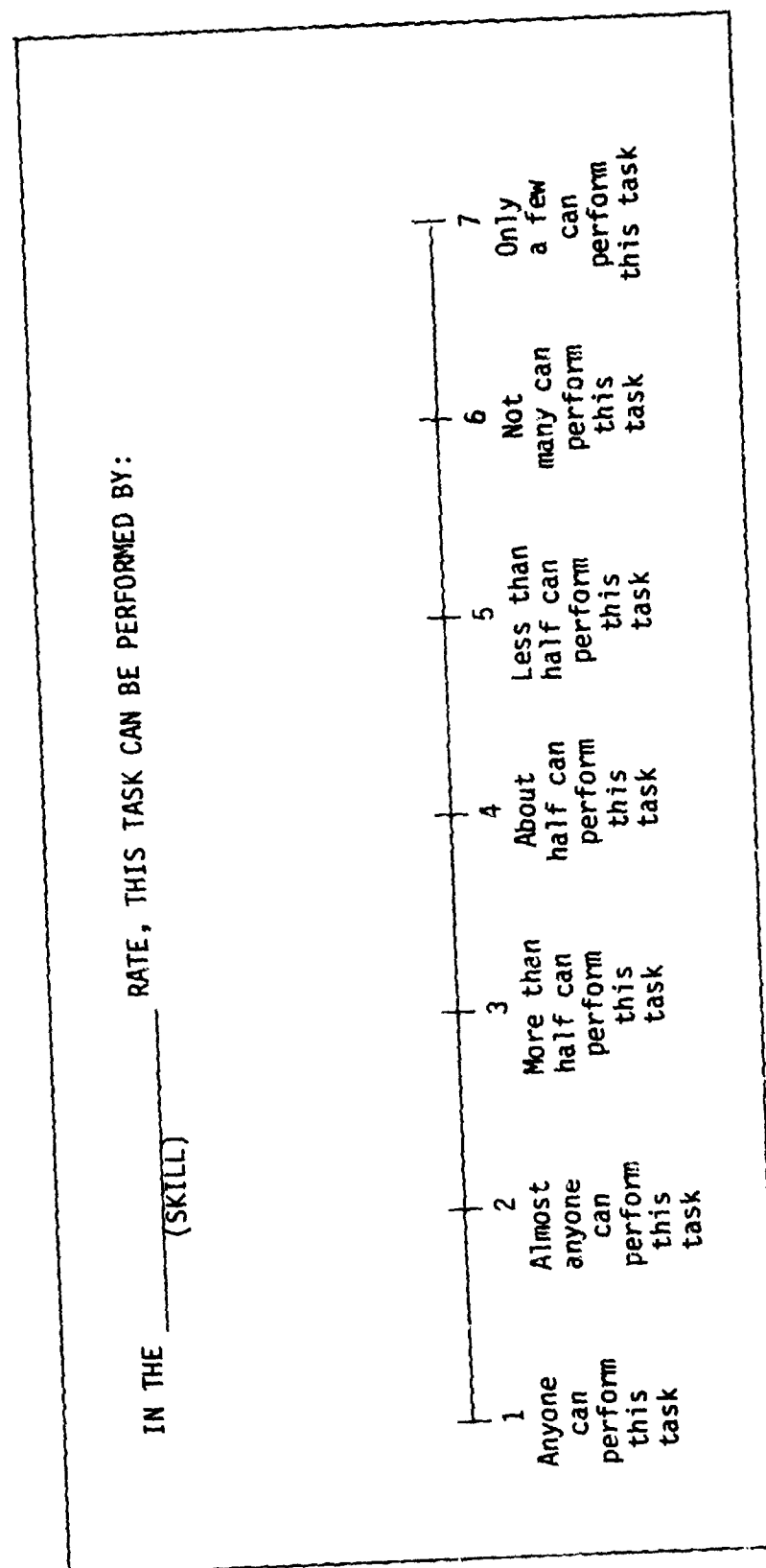


FIGURE 3. TASK REQUIREMENTS SCALE.

tested with several hypothetical situations within each Navy rate (BM, GM, HT, and MM) to ensure that it would accommodate the maximum range of situations.

Criticality defined as Task Importance emphasized the significance of proper task performance in relation to effective job completion and equipment breakdown or damage. The Task Importance scale, presented in Figure 4, allowed for the assessment of the relative criticality of performing the task correctly and of the results of the task performance on job performance.

The final scale used to assess task criticality was Physical Effort. The concept and definition of effort were generic and were summarized as the degree of physical exertion experienced in performing the task. The 7-point behaviorally anchored scale (Figure 5) was found to be a valid predictor of metabolic and ergonomic costs of task performance during the first year's study on this project (Hogan, Ogden, Gebhardt, & Fleishman, 1979). The first year's study also established that the physical parameters of stamina and strength accounted for the ratings in tasks that were perceived to require a great deal of effort.

The use of the Effort Scale in the present research served two purposes. First, it was used as a criticality measure to insure that the tasks used in the later stages of the Physical Ability Analysis (PAA) would encompass the full spectrum of the physical effort scale. Second, the use of the Effort Scale in this phase provided another population sample, supervisors (E6-E9) in each of the four Navy rates. This sample's ratings were later compared with the ratings of the incumbents (E2-E6) in each Navy rate and the job analysts. Therefore, the use of the physical effort concept as an index of criticality appeared to satisfy the psychometric and diverse utility requirements of the study.

A final developmental consideration involved the adaptation of the survey instructions to the context in which the jobs for each rate were performed. General directions were developed to introduce the four rating scales and to reflect the distinction between two sizes of ships (see Appendix A). It was recognized during the preliminary planning

IMPORTANCE

RATE HOW IMPORTANT THIS TASK AND SUBTASKS ARE TO THE JOB.

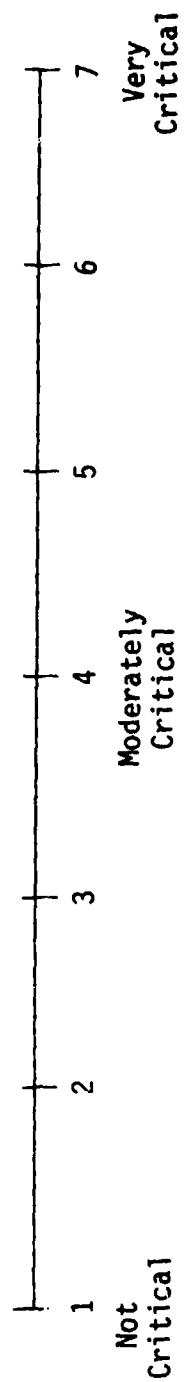


FIGURE 4. TASK IMPORTANCE SCALE.

# EFFORT

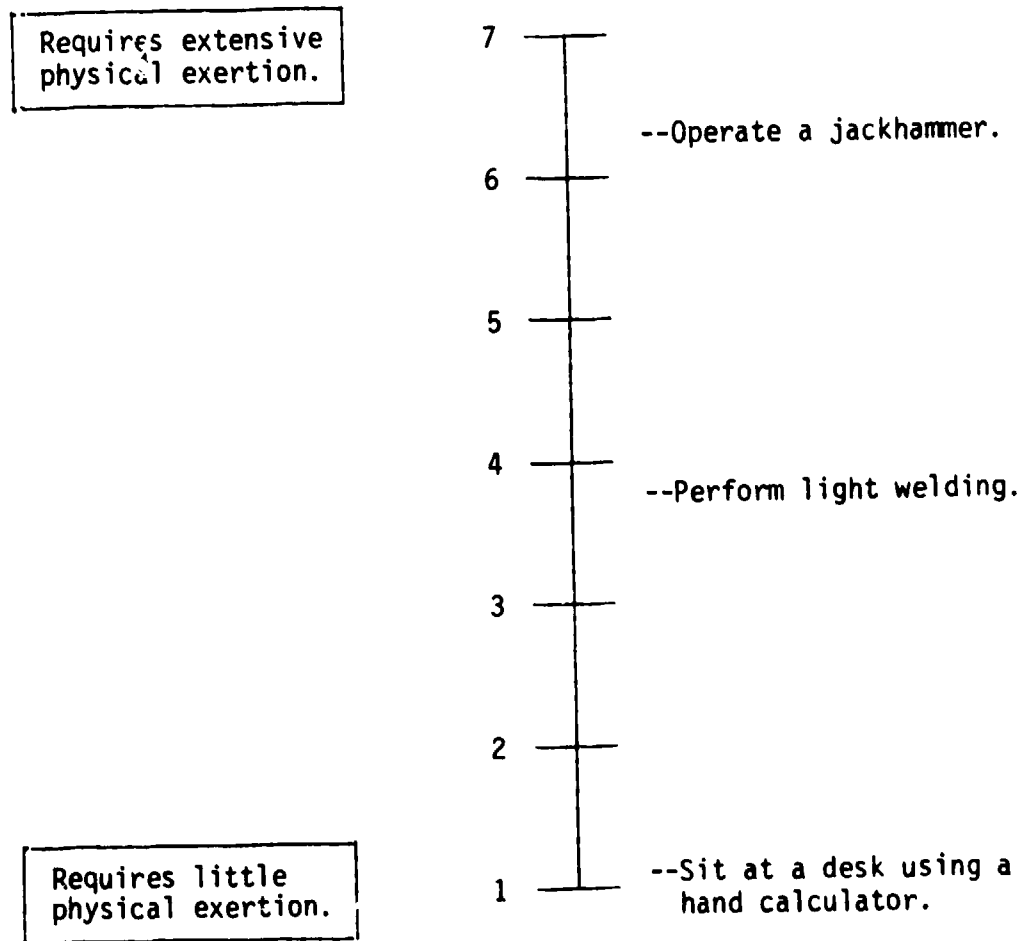


FIGURE 5. PHYSICAL EFFORT SCALE.

of the study that the size of the ship might alter the physical demands of the tasks to be performed.

Ship size was indicated by the terms auxiliary and combat which are Naval classifications that provide some information about the dimensions of the ship. For example, a tender or oiler (e.g., AOE) was classified as an auxiliary ship and a destroyer (e.g., DDG) was classified as a combat ship. This Naval classification system was altered to meet the needs of this study. This alteration specified that auxiliary included all large ships carrying a minimum of 1,000 personnel and that combat included all small ships with a maximum personnel complement of 500. This meant ships such as carriers (CV), stores (TAF), ordinance (AE), and landing platform helo (LPH), etc., were classified as auxiliary, while ships the size of destroyers (DD, CG, DDG), landing ship docks (LSD), and fast frigates (FF) were classified as combat.

### Subjects

The sample consisted of 71 Navy personnel from the four Navy rates of Boatswain's Mate (BM), Gunner's Mate (GM), Hull Technician (HT), and Machinist's Mate (MM) with an average of 15.99 years Naval experience. All subjects used the four criticality scales to rate the tasks from the appropriate task list for each Navy rate. The sample population consisted of Navy chiefs whose pay grade ranged from E6 to E9, with the majority being E6. Table 1 presents the individual data for all four Navy rates.

The task lists were administered to the supervisors (E6-E9) in each of the four Navy rates (BM, GM, HT, and MM). These task lists are located in Appendix C and an example of the answer form for each rate is found in Appendix B.

TABLE 1  
DESCRIPTIVE STATISTICS FOR NAVY SUPERVISORS

Navy Rate	Mean Age	Mean Years in Navy	Number of Subjects in each Pay Grade					MD*
			E-5	E-6	E-7	E-8	E-9	
Boatswain's Mate (BM)	38.19	19.69	0	2	6	6	2	1
Gunner's Mate (GM)	31.94	12.71	1	13	3	0	0	0
Hull Technician (HT)	36.81	18.06	0	5	7	4	0	0
Machinist's Mate (MM)	32.89	13.50	0	11	3	4	0	3

\*MD = Missing data.

## PHASE I - RESULTS

The data consisted of ratings on three criticality measures and a separate measure of physical effort from four Navy rates (i.e., BM, GM, HT, and MM) on 584 tasks. The results are discussed in terms of ratings on board different sized vessels, descriptive statistics, and a decision model for the determination of the final task list.

### Measurement of Differences Between Auxiliary and Combat Ratings

A t-test was performed on each of the major tasks for each criticality scale to determine if there was a significant difference between performing the task on a large ship (auxiliary) and small ship (combat). The .05 level of significance was selected a priori in order to allow a difference between ship size classification to be revealed. In order not to inflate the Type 1 ( $\alpha$ ) error, the .05 significance level was corrected using the formula,  $1-.999^k$ , where k equals the number of ratings (Table 2).

It was found that there were no significant differences between the ratings for large (auxiliary) and small (combat) ships. The results of the analysis for the four criticality measures for each rate are found in Table 3. An absolute mean difference for each task was calculated from the difference of the means on the combat and auxiliary ratings. Following this procedure an overall mean difference was computed for each criticality scale using the absolute mean difference on all ratings. Table 3 presents the mean differences which illustrate the similarities between work on large and small ships.

### Descriptive Statistics

The results of the criticality ratings for each Navy rate are found in Appendix C. The means and standard deviations for the tasks on the four scales are found adjacent to the task statement. The means for

TABLE 2  
DIFFERENCES BETWEEN AUXILIARY AND COMBAT SHIP RATINGS

Navy Rate	Criticality Scale	Number of Rated Major Tasks	Corrected Level	DF	Range of P Values
BM	Frequency	38	.037	16	.373 - 1.000
	Task Requirements	38	.037	16	.082 - 1.000
	Task Importance	38	.037	16	.222 - 1.000
	Effort	38	.037	16	.119 - 1.000
GM	Frequency	20	.020	16	.369 - 1.000
	Task Requirements	20	.020	16	.512 - 1.000
	Task Importance	20	.020	16	.349 - 1.000
	Effort	20	.020	16	.064 - 1.000
HT	Frequency	27	.027	15	.404 - 1.000
	Task Requirements	27	.027	15	.240 - 1.000
	Task Importance	27	.027	15	.293 - 1.000
	Effort	27	.027	15	.218 - 1.000
HM	Frequency	30	.030	20	.454 - 1.000
	Task Requirements	30	.030	20	.203 - 1.000
	Task Importance	30	.030	20	.277 - 1.000
	Effort	30	.030	20	.249 - .952



TABLE 3

## OVERALL MEAN DIFFERENCE FOR AUXILIARY AND COMBAT SHIP RATINGS

Navy Rate	Criticality Scale	Mean	Standard Deviation
BM	Frequency	.233	.237
	Task Requirements	.362	.275
	Task Importance	.353	.293
	Effort	.567	.333
GM	Frequency	.217	.164
	Task Requirements	.292	.241
	Task Importance	.325	.294
	Effort	.370	.299
HT	Frequency	.343	.282
	Task Requirements	.386	.256
	Task Importance	.429	.336
	Effort	.487	.255
MI	Frequency	.179	.165
	Task Requirements	.253	.210
	Task Importance	.271	.182
	Effort	.265	.189

each scale were later examined in detail as part of the determination of criticality.

#### Decision Model for Determination of Final Task List

A statistical decision model was employed to identify not only tasks with varying criticality, but also tasks with varying physical demands. Since the primary focus of the research was to develop perception of physical effort into an accurate and useful methodology for evaluating the physical demands of Navy jobs, it was important to select tasks within each Navy rate that not only represented the range of the effort scale, but also displayed variance in frequency, task requirements, and task importance. The use of variance in the latter three scales was deemed necessary to reflect varying conditions (e.g., under attack while underway, reconnaissance missions, peace time, etc.) under which Navy personnel must operate. A statistical decision model was developed to meet these prerequisites (Figure 6).

The decision model consisted of three steps. First, the raw scores were transformed into Z-scores via a fortran coding program. Second, a range bracketing each Z-score (i.e., -2, -1, 0, +1, +2) was established to aid in the selection of a variety of tasks. The ranges established were +0.95 to +1.05, -0.07 to +0.07, and -.095 to -1.05 (standard scores from the mean) for +1, 0, and -1, respectively, with tasks exceeding +1.90 or -1.90 qualifying in the +2 and -2 standard score ranges. Tasks representing these ranges were retained for further analysis. Tasks excluded from these ranges were temporarily deleted. The tasks retained were evaluated on two criteria: (1) low standard deviation across subject ratings for the mean of the task (Appendix C), and (2) specified level of physical effort. The second criteria was established to ensure that the selected tasks would represent the range of effort ratings for all tasks. If a task did not meet these two requirements it was eliminated from task selection for that

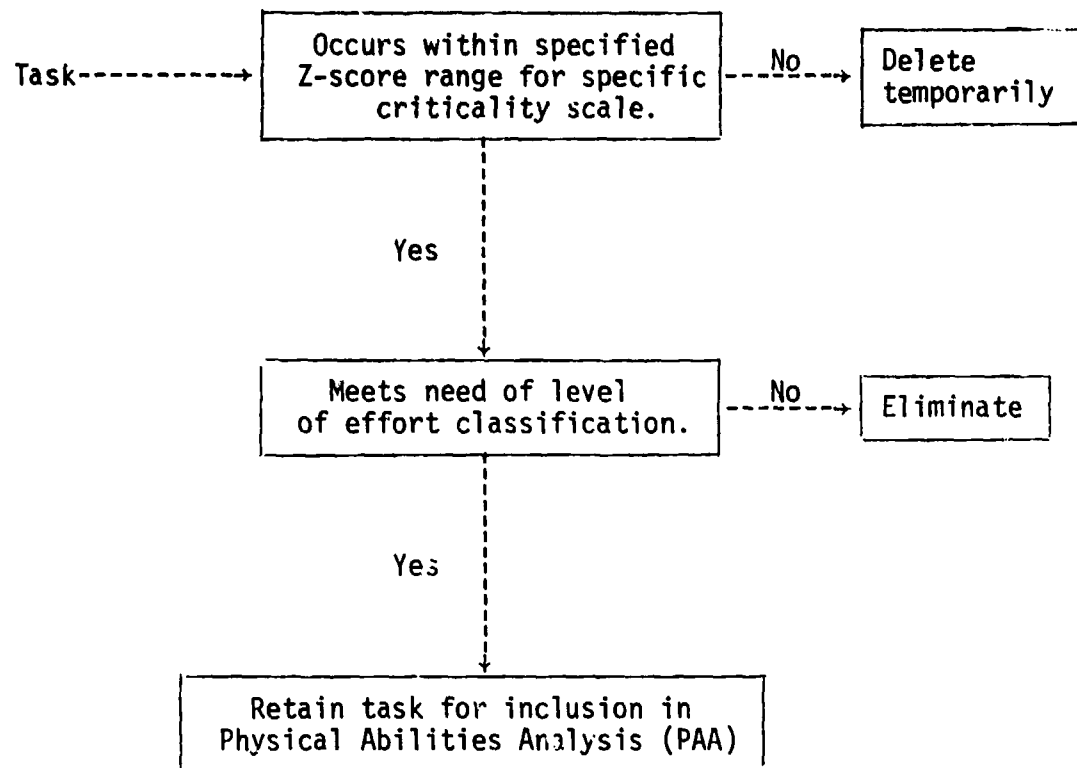


FIGURE 6. CONCEPTUAL DECISION MODEL FOR DETERMINING TASK CRITICALITY ON THE BASIS OF SCALE RATINGS.

particular scale (e.g., frequency). However, this did not eliminate it from inclusion on one of the remaining three scales.

#### Results of Decision Model

This decision model was applied separately to all four scales within each Navy rate. The final product was a separate task list specific to each Navy rate. Twenty-three tasks were selected for each rate from a total of 591 tasks (i.e., BM = 166, GM = 31, HT = 177, and MM = 167). Of the tasks chosen for each rate, six tasks generic to all Navy personnel were selected from the 41 generic tasks that were included on the original task list. A complete list of the tasks selected for each rate appears in Appendix D. The Z-score for the scale from which the task was selected and the effort evaluation are presented after each task statement.

Several instances occurred in which no tasks were located within the stated criterion range for a bracket. When this situation arose tasks temporarily deleted in Step 2 were re-evaluated and selected on the basis of providing the most variability within a scale. Further, a few generic tasks did not meet the selection criteria, but were included for the purpose of providing several tasks that were applicable to all Navy personnel. These tasks that did not meet the selection criteria but that were either generic tasks or tasks indigenous to that specific Navy rate are followed by a brief explanatory note.

## PHASE II - METHOD AND PROCEDURE

Phase I resulted in the identification of 23 tasks for each rate. The last six tasks on each list were identical and represented tasks done by all non-commissioned Navy personnel (E2-E5) at some time in their career. These task lists were used in Phase II.

Phase II involved the identification of the specific physical abilities involved in the performance of these Navy tasks. Physical Abilities Analysis (PAA) (Fleishman & Gebhardt, 1979) was the method used to evaluate the physical demand of the critical tasks identified in Phase I. This job analysis method has been fully described in several publications (Theologus, Romashko & Fleishman, 1973; Fleishman & Hogan, 1978; Meyers, Gebhardt & Fleishman, 1979). Physical Abilities Analysis has been used in a variety of work settings. These environments ranged from physically demanding jobs such as Army occupational specialties (Meyers et al., 1979), oil refinery jobs (Hogan et al., 1980), and manual material handling jobs (Hogan, Ogden, & Fleishman, 1979) to white collar jobs (Hogan, Ogden, & Fleishman, 1978).

Various research has indicated that the strength components of the upper and lower body were not correlated (Asmussen, Hansen, & Lammert, 1965; Borchart, 1968; and Laubach, 1976). However, Asmussen et al., and Borchart did find significant correlations between muscle groups within a specified extremity. These results and observations of the various work positions during previous job analyses prompted the research by Meyers et al. (1979) to expand the static, dynamic and explosive strength factors into upper and lower body extremities.

The PAA manual was further modified prior to being administered to the Navy personnel. The previous form of the manual contained two flexibility scales, dynamic and extent (Hogan et al., 1979). These two scales were collapsed into one index of flexibility to facilitate a more global representation of these factors. This single flexibility factor was found to be useful when dealing with military and industrial work situations that encompass a wide variety of jobs. Therefore, in this study flexibility

was defined as the ability to bend, stretch, twist, or reach out with the body, arms, or legs. This definition was in keeping with the general concept of flexibility and included both the extent and dynamic aspects from the previous flexibility definitions.

Next, new anchors representing different levels of flexibility were developed. The research team gathered 43 tasks that involved varying degrees of flexibility. Twenty-eight graduate students from the University of Maryland provided independent ratings based on the degree to which they believed the flexibility factor was required to perform the task. The results of these ratings are illustrated in Appendix F. Tasks from this list were chosen as behavioral anchors based on their relevancy to the specific ability of flexibility as well as the quality of their psychometric properties. Anchors were selected which were representative of three levels of flexibility--high (7.00 to 5.00), moderate (4.99-3.00), and low (2.99 to 1.00). Potential anchors were ranked within the three categories according to their standard deviations (i.e., reliability of the mean rating). A task with a low standard deviation was selected as the anchor at each level of the scale. The final flexibility scale is included among the scales shown in Appendix E.

The Effort scale also was included as part of the PAA manual. The use of effort as an index for assessing work cost has been established by many researchers (Hogan et al., 1979; Borg, 1962; Borg, 1977; Wardle, 1978; Pandolf, 1978). In Phase I, effort was used as a criticality measure, but in Phase II, it was validated as a measure of physical performance against the other physical abilities contained in the PAA manual.

### Subjects

The sample of incumbent raters was drawn from over twenty different ships docked at the Naval Fleet Training Center in San Diego, California. The raters were stationed aboard both auxiliary (tenders, AOE, AO, etc.) and combat (DDG, CG, FF, etc.,) ships, thus ensuring a sample population with work experience in varied environments. Subjects were selected randomly, based upon shipboard availability.

The 69 incumbents from the four Navy rates (BM, GM, HT, MM) were non-supervisory personnel with pay grades of E-2 to E-6.\* The subjects ranged in age from 18 to 40 years and had spent one to twenty years in the Navy. The means and frequencies by Navy rate and the grand means are displayed in Table 4.

#### Physical Abilities and Effort

In the present study, the Physical Abilities Analysis and Effort ratings of the critical tasks for each rate (BM, GM, HT, and MM) were provided by two groups during the period of September 8-17, 1980, at the Navy Fleet Training Center (FTC) in San Diego. The first group was composed of 13-20 incumbents (E2 through E6) in each Navy rate. The four rates were scheduled for either the morning or the afternoon on one of two consecutive days. Each person was given a set of instructions and a copy of the PAA and Effort scales. Written instructions were provided and a detailed verbal explanation accompanied these instructions. Additionally, rater problems such as halo, leniency, and central tendency, were discussed. The PAA scales were distributed in groups of two (e.g., upper and lower static strength). The Effort scale was given by itself after the completion of all PAA scales. Each set of scales was carefully reviewed prior to having the Navy personnel rate the tasks on the two specified scales. All tasks were rated on a single scale before proceeding to the next scale. Appendix E contains the instructions, the PAA and Effort scales, and their definitions.

The second group of ratings was provided by a panel of two ARRO professional staff and one NHRC staff member. The ratings were obtained through a two-step process. The first step required raters to evaluate tasks independently on the physical ability scales for all Navy rates.

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\*It was learned later that one Boatswain's Mate was an E-8; it was decided that a single exception would not adversely affect the study.

TABLE 4. DESCRIPTION OF INCUMBENT RATERS

Rate	n	Mean Age	Mean Weight (pounds)	Mean Height (inches)	Grade						Mean Years in Navy
					E-2	E-3	E-4	E-5	E-6	E-8	
Boatswain's Mate	20	25.9	169.2	70.8	0	3	9	4	3	1	6.7
Gunner's Mate	17	24.5	171.5	70.7	0	2	8	3	3	0	4.7
Hull Technician	19	23.3	158.8	68.7	0	3	8	6	2	0	4.7
Machinists Mate	13	23.7	179.7	70.8	2	0	6	3	2	0	4.8
TOTALS	69				2	8	31	16	10	1	
GRAND MEANS		24.4	168.9	70.3							5.3



This required raters to become familiar with the physical performance of the tasks by (1) observing the work behavior and the outcome of the task performance, and (2) having the raters actually perform the tasks when feasible (e.g., loading dummy projectiles into the 5"-54 gun). The observations and rater participation took place aboard tenders, destroyers (DDG), and landing platform helos (LPH). The firefighting and damage control tasks were simulated at FTC. The ARRO/Navy team not only observed the fire fighting, but actually participated in the various training modules given to all enlisted personnel. After all information about the task was gathered, it was rated by each rater independently using the PAA manual and the rating form in Figure 7.

Each task was rated on the same eleven scales used by the incumbents (E2-E6) in each Navy rate. Tasks that were duplicates among the rates (e.g., the last six tasks on each list) were rated once by the ARRO/Navy team. Where applicable, the behavioral components of the task which were identified with a specific ability were noted in the space provided to the right of each ability on the rating form. These notations provided additional information used in the second step, consensus.

After each analyst had rated all the tasks for a Navy rate (e.g., BM), a consensus rating was obtained on each scale for the tasks. This step consisted of a group review of the task under consideration and an analysis of the physical components that influenced an individual's rating. These components were discussed, agreement was reached, and a consensus rating was obtained. This step addressed the issue of rater bias, that is one rater providing either consistently high or low ratings.

A summary of the types of ratings obtained for each group (supervisors (E6-E9), incumbents (E2-E5), and ARRO/Navy team) is presented in Table 5. The results of comparisons between and among groups is reported in the Results section of this report.

NAVY RATE: BM GM HT MM      RATER \_\_\_\_\_

TASK AND RELATED EQUIPMENT: \_\_\_\_\_

TASK #: \_\_\_\_\_

\_\_\_\_\_ U.B. Static Strength \_\_\_\_\_

\_\_\_\_\_ L.B. Static Strength \_\_\_\_\_

\_\_\_\_\_ U.B. Dynamic Strength \_\_\_\_\_

\_\_\_\_\_ L.B. Dynamic Strength \_\_\_\_\_

\_\_\_\_\_ U.B. Explosive Strength \_\_\_\_\_

\_\_\_\_\_ L.B. Explosive Strength \_\_\_\_\_

\_\_\_\_\_ Trunk Strength \_\_\_\_\_

\_\_\_\_\_ Stamina \_\_\_\_\_

\_\_\_\_\_ Flexibility \_\_\_\_\_

\_\_\_\_\_ Equilibrium \_\_\_\_\_

\_\_\_\_\_ Effort \_\_\_\_\_

FIGURE 7. ARRO/NAVY ANALYSTS RATING FORM.

TABLE 5  
CRITICAL TASK MEASUREMENTS

Raters	Task Criticality	Effort*	PAA
Supervisors in Each Rate (E7 through E9)	✓	✓	
Incumbents in Each Rate (E2 through E6)		✓	✓
ARRO/Navy Team (Job Analysis Experts)		✓	✓

\*The use of effort as an index for assessing work cost is described in Hogan, Ogden, Gebhardt, and Fleishman (1979).

## PHASE II - RESULTS

The data consisted of ratings on ten physical abilities measures and a separate measure of physical effort for four Navy rates (i.e., BM, GM, HT, and MM) and a group of job analysts. Additionally, the effort ratings from Navy Supervisors (E6-E9) were compared to the other groups. These groups will be identified throughout this section as follows: Navy personnel (E6-E9) from each rate used in Phase I are titled supervisors; Navy personnel (E2-E6) from each rate used in Phase II are titled incumbents; and, finally, the ARRO/Navy team of job analysts are titled analysts.

### Descriptive Statistics

Descriptive statistics were calculated for all PAA and Effort ratings for each task across all rating groups. Appendix G contains the means and standard deviations for the eleven scales. These scales are titled upper body static strength (UBSS), lower body static strength (LBSS), upper body dynamic strength (UBDS), lower body dynamic strength (LBDS), upper body explosive strength (UBES), lower body explosive strength (LBES), trunk strength (TS), stamina (S), flexibility (FLEX), equilibrium (EQ), and effort (EFF). Both the incumbent, analyst, and consensus ratings are found in Appendix G. Effort ratings for supervisors are located in Appendix C. Two items should be noted with respect to the analyst and consensus ratings. First, tasks 2, 3, 4, 5, and 8 on the BM task list were not available for observation by the analysts. Thus, these tasks were not rated and were coded as zeroes. Second, since only one score existed for a consensus rating, these ratings are listed as integers and have no standard deviations.

The task lists were constructed to reflect three levels of physical effort in order to validate the effort scale for use in evaluating Navy tasks and personnel. These levels were defined as low (1 to 2.9), medium (3 to 4.9), and high (5 to 7). As can be seen in Table 6, the results indicated that the task lists did indeed reflect a wide range of abilities and

TABLE 6  
PAA AND EFFORT SCALE RANGES

	PAA Range	Effort Range
<hr/>		
Incumbents		
BM	2.0 - 6.5	3.0 - 5.5
GM	1.8 - 5.9	2.7 - 5.9
HT	1.5 - 5.8	2.2 - 5.3
MM	1.3 - 5.5	1.7 - 5.4
<hr/>		
Analysts		
BM	1.0 - 7.0	2.3 - 6.0
GM	1.0 - 7.0	1.0 - 6.0
HT	1.3 - 7.0	2.0 - 6.0
MM	1.3 - 7.0	2.0 - 6.0
<hr/>		

effort. The BM range on the 7-point scale was 2.0 to 6.5 for the PAA scales and 3.0 to 5.5 for the effort scale. The GM ranges were 1.8 to 5.9 and 2.7 to 5.9 for PAA and effort scales, respectively. The PAA and Effort scale ranges for HT and MM were 1.5 to 5.8 and 2.2 to 5.3, and 1.3 to 5.5 and 1.7 to 5.4, respectively. The majority of the high ratings were located in the upper body strength factors for the PAA scales. In all Navy rates, the lowest effort mean rating for an individual task ranged from 0.6 to 1.0 points higher than that of the lowest PAA scale rating for a single task. This indicated that the raters were considering all the physical aspects of a task when rating the overall effort to complete that task.

The descriptive statistics on the analyst data revealed a similar pattern between the PAA scales and effort scale for all four Navy rates (Table 6). However, the analysts used the complete scale range for two rates. This occurred because the task that was rated as a seven was one of the six generic tasks that appeared on all task lists. It should be noted that the analysts also exhibited a similar range for the effort scale. It was concluded that the analysts possessed a more in depth understanding of the physiological principles associated with the scales and therefore used the full 7-point range in their ratings.

#### Rater Reliability

The reliability of the mean ratings (interrater agreement) was calculated for all ten PAA scales and the effort scale. First, the reliability coefficient for an individual rating was determined using a two-way ANOVA with both raters and tasks as random effects (Shrout & Fleiss, 1979). The Spearman-Brown formula (Ghiselli, 1964) was then used to transform the reliability of the individual rater into a multiple reliability coefficient for 20 raters. These reliability coefficients for each rate are reported in Table 7. The reliability coefficients for the PAA scales for all four Navy rates were quite large. This indicated that the ratings on the tasks were ordered in an almost identical fashion by each rater. Several factors influenced these ratings. First, precise definitions and behavioral anchors were associated with each scale. Second, the tasks

TABLE 7  
RELIABILITY OF THE PAA AND EFFORT SCALE RATINGS\*

Navy Rate	PAA Scales										Effort Scale
	UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	
BM	0.99	0.99	0.98	0.97	0.97	0.97	0.98	0.99	0.98	0.97	0.81
GM	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.98	0.99	0.93
HT	0.99	0.99	0.99	0.97	0.99	0.99	0.98	0.99	0.99	0.99	0.79
MM	0.99	0.99	0.99	0.99	0.99	0.98	0.98	0.99	0.99	0.99	0.88

\*Reliabilities are for the mean ratings of twenty raters.

being rated were chosen to represent all levels of physical demand. Third, the tasks being rated were the tasks performed by the rater approximately four times per year, depending upon the environmental and deployment conditions. The combination of these three factors produced highly reliable ratings on the PAA scales.

The reliability coefficients for the Effort Scale were computed for both supervisors and incumbents by collapsing the effort ratings across these two groups. Although the effort scale reliabilities were not as high as those for the PAA scales, the reliability coefficients for all four Navy rates were found to range from 0.79 to 0.93. These reliability coefficients demonstrated that the Effort scale was an accurate indicator of the overall physical demand of a task.

#### Comparisons of Effort and PAA Ratings Among Rater Groups

It was of interest within the confines of this study to determine if supervisor, incumbent, and analyst ratings were similar for both the Effort and PAA scales. The following sections compare (1) the effort ratings for all three groups, (2) the PAA ratings for incumbents and analysts, and (3) the generic tasks across all incumbents in all four Navy rates. Separate two-way ANOVAs were employed to detect between-group differences for all categories of ratings. In all cases tasks were considered to be a random variable.

Effort Ratings. The effort ratings for each Navy rate were analyzed for differences across the three rating groups, supervisors, incumbents, and analysts. The results for each Navy rate indicated that there were no significant differences ( $p < .05$ ) between the three rating groups when tasks of varying physical demand were rated on the effort scale. Further, these results showed similar rating structures across groups.

PAA Ratings. The incumbent and analyst ratings for all PAA scales were analyzed separately by Navy rate. It was found that no significant differences ( $p < .05$ ) between rater groups were present for any of the four Navy rates. This result tended to indicate that job analysts who



possessed knowledge of work principles and job-related tasks were able to accurately assess the physical requirements of tasks with varying levels of physical demand.

Generic Tasks. Six generic tasks performed by the majority of Navy personnel were selected for inclusion on the task lists for BM, GM, HT, and MM. The reason for including these tasks was to determine if effort ratings on these tasks differed depending upon the past experience of the rater group. Additionally, it was of interest to determine if there was a significant difference in the ratings on the PAA scales for these six tasks across Navy rates. Two analyses were performed. One included only the incumbents from each Navy rate and the other added the analysts as a fifth rating group. The results showed that no significant differences ( $p < .05$ ) in either effort ratings or PAA ratings were present whether the analysts were or were not included in the analysis. These results showed that different rater groups with varied backgrounds in task knowledge and performance were able to accurately assess the physical demand of the tasks.

#### Comparison of the Analysts' Mean Ratings and Consensus Ratings

As mentioned previously, a two-step process was used by the analysts to secure ratings on the Navy tasks. The first step required the analysts to independently rate all the Navy tasks on the Effort and PAA scales. The second step consisted of a review session to obtain a consensus rating for each task. It was of interest to determine if these consensus ratings differed from the mean ratings of the analysts.

Separate analyses of variance were performed on the unique tasks for each Navy rate and on the generic tasks for all physical abilities and effort. Prior to performing the ANOVA, the consensus data was subtracted from each analyst's ratings across all tasks and abilities. The ANOVAs yielded twenty F ratios, three of which were significant at the .05 level. Two of the significant F ratios exhibited were tasks by abilities interactions. These interactions indicated that the ratings of one or more of the tasks on an ability differed from the consensus

rating. The third significant F ratio occurred on the main affect of the generic tasks due to the lack of between-rater variability. Since 17 of the 20 F ratios were non-significant ( $p > .05$ ), these results suggested that there was consistent agreement between the mean ratings and consensus ratings. Therefore use of the consensus ratings instead of the mean ratings would not have affected the results of the other analyses in this study. Consensus ratings and statistically averaged ratings appear to produce equivalent results.

#### Correlation of Effort Ratings with Physical Abilities Ratings

The correlation matrix for the Effort and PAA ratings is presented in Table 8. This matrix was generated by collapsing across the three rater groups, supervisors, incumbents, and analysts, for the effort ratings and collapsing across the incumbents and analysts for the PAA ratings. A mean was computed across subjects to yield a task matrix for each physical ability. The generic tasks were only entered into the matrix one time across the four rates. This procedure reduced the overall variance by increasing the total number of tasks to 74 across four Navy rates as opposed to 23 for one rate.

The concept of effort was found to be highly correlated with upper ( $r = 0.94$ ) and lower ( $r = 0.91$ ) body static strength, upper ( $r = 0.95$ ) and lower ( $r = 0.94$ ) body dynamic strength, trunk strength ( $r = 0.95$ ), and stamina ( $r = 0.93$ ). These results paralleled the physical ability correlates of mean rated effort from the first year's study (Hogan, et al., 1979). The first year's study found effort to be highly related to strength (static, dynamic, explosive, and trunk) and stamina with correlations greater than 0.90. The study, however, did not break down the strength scales into upper and lower body factors. This added dimension might explain the lower correlations found for the explosive strength scales in the second year's study.

The results of the second year's study substantiated that tasks perceived by job incumbents and supervisor's as requiring moderate to

TABLE 8

## INTERCORRELATIONS AMONG PHYSICAL ABILITIES AND EFFORT RATINGS

	UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
Upper Body Static Strength											
Lower Body Static Strength	.94										
Upper Body Dynamic Strength	.95	.92									
Lower Body Dynamic Strength	.90	.94	.93								
Upper Body Explosive Strength	.87	.84	.89	.82							
Lower Body Explosive Strength	.88	.94	.89	.92	.88						
Trunk Strength	.91	.91	.90	.95	.81	.87					
Stamina	.89	.88	.92	.94	.84	.89	.93				
Flexibility	.61	.56	.61	.64	.50	.53	.69	.66			
Equilibrium	.77	.76	.80	.83	.68	.73	.84	.83	.80		
Effort	.94	.91	.95	.94	.85	.89	.95	.93	.71	.84	

high levels of effort were also perceived to require moderate to high levels of strength and stamina. It should be noted that since the tasks selected for inclusion in each task list represented the entire range of the Effort scale (1 to 7), the high correlations also indicated that tasks perceived as possessing low amounts of strength and stamina were also perceived as requiring low amounts of effort. Effort was found to correlate with other abilities but to a lesser extent.

#### Comparison of High Physical Demand Tasks Across Four Navy Rates

The BM, GM, HT, and MM rates were chosen for this study because these rates were considered to be four of the most physically demanding rates in the Navy from an overall job perspective. In order to compare the physical demands of the four Navy rates, the mean for the three highest rated tasks from each PAA scale and the Effort scale were computed. Figure 8 illustrates the mean ratings for each Navy rate and the overall relationship of effort to the other physical abilities. For example, effort appears to be most closely related to trunk strength and upper body static and dynamic strength for all four Navy rates. These relationships were similar to correlates of mean rated effort with the 10 physical abilities in four Navy rates (Table 8). The lower body static and dynamic strengths were also considered important factors in performance of physically demanding tasks.

Although Table 8 shows stamina to be highly correlated with effort, Figure 8 shows that only the GM rate considered high levels of stamina to be required in their job. The mean within the other three rates indicated that the tasks selected for this study did not require high levels of stamina. This graphic presentation seems to indicate that of the three highest rated tasks for each physical ability high levels of upper body static and dynamic strength and trunk strength were found to be required for successful job performance. It should be remembered that all the physically demanding tasks within a Navy rate were not included in the task lists. Thus, these comparisons are made from a selected group of tasks which required high levels of physical ability. However, the mean results from these selected groups of tasks were

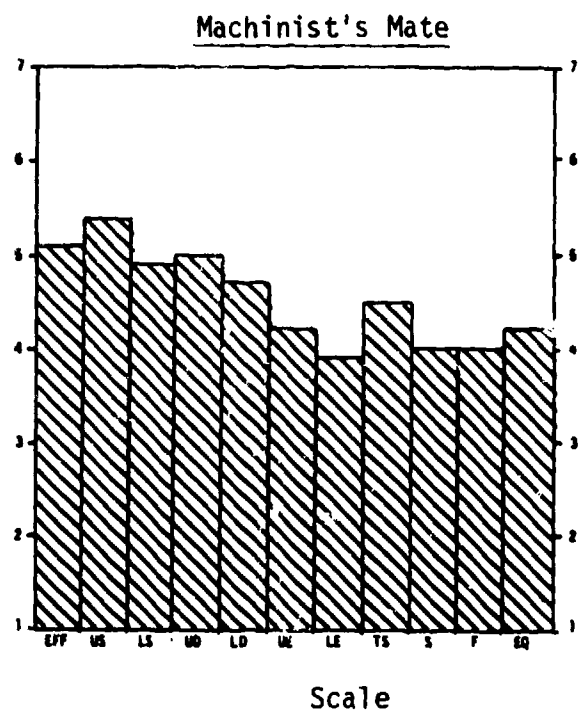
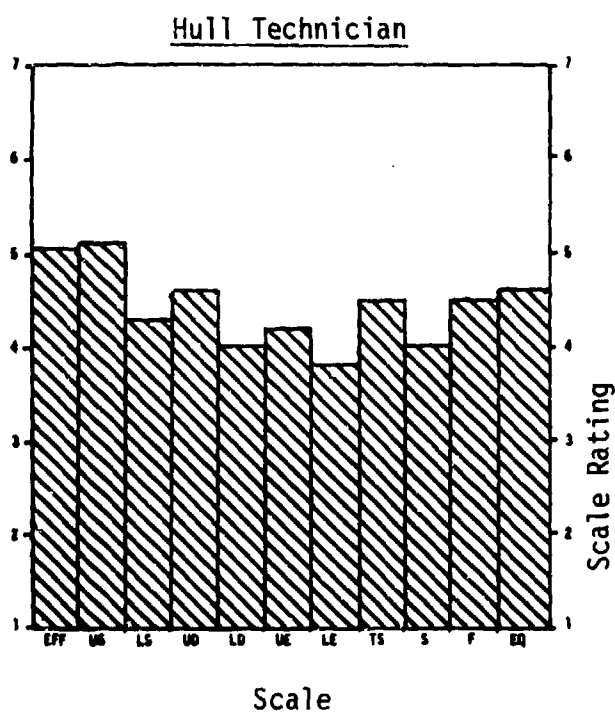
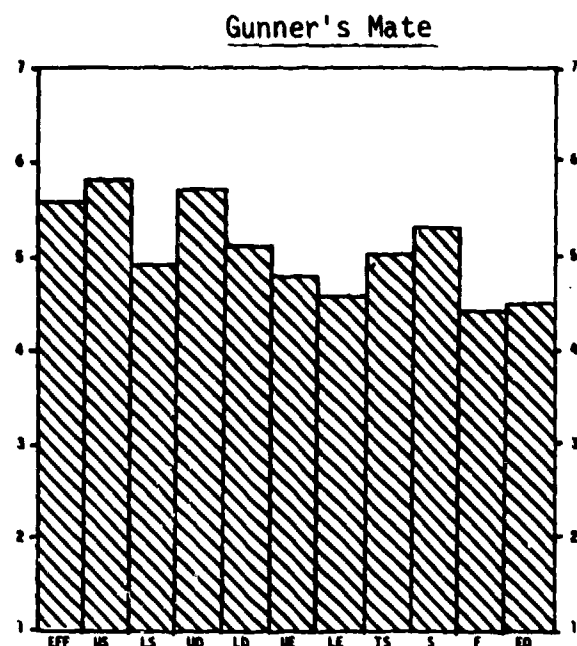
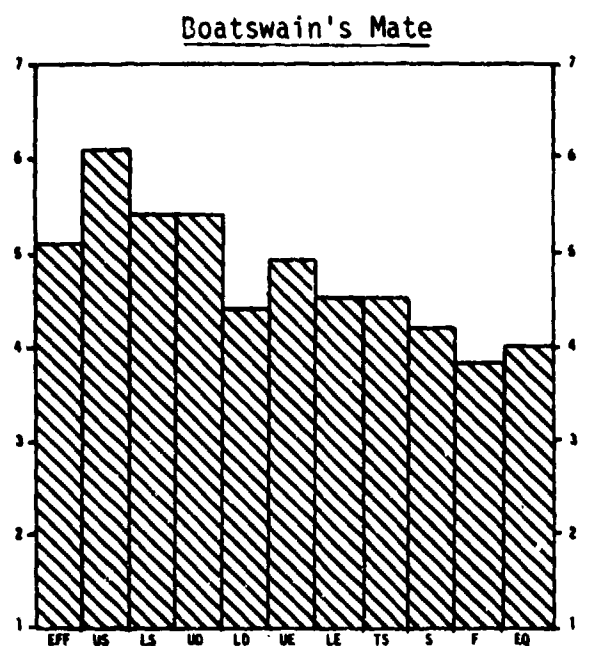


FIGURE 8. MEANS OF THREE HIGHEST RATED TASKS ON EACH SCALE.

generally in agreement with the correlations of effort with the physical abilities (Table 8). Had a full range of physically demanding tasks been used, the profile for these four rates probably would have been different.

While rated perceived effort has been found to be a reliable and valid device for predicting the work costs of tasks found in the first year's study, the similar effort ratings found for analogous Navy tasks in the second year's study indicate that job incumbents and supervisors can reliably use the index of physical effort to discriminate between tasks with both high and low physical demand. These results further suggest that ratings by job incumbents and supervisors are indicative of the ergonomic or metabolic costs of physical task performance and can be used as a means to rank order large groups of jobs as well as tasks within a job according to their physical demand. The wide diversity of Navy jobs could then be classified into a limited number of common levels of physical demands involved in job performance. This information would also provide a basis for developing physical performance standards for Navy jobs.

## DISCUSSION

The results of this study supported past research indicating that a perceived physical effort scale was a valuable tool for assessing the physical requirements of job-related tasks with varying physical demands (Hogan et al., 1979, 1980); Hogan & Fleishman, 1979; Borg, 1972). Further, these results demonstrated that (1) the effort scale was a useful assessment methodology for evaluating the physical demands of Navy tasks, (2) Navy personnel in all four jobs were able to rate reliably the amount of physical effort used in performing tasks with varying physical demands, and (3) a high degree of agreement was found for the three rater groups, incumbents, supervisors, and job analysts.

The study also established the physical abilities most related to perceived physical effort. These were upper and lower static and dynamic strength, trunk strength, and stamina. This was demonstrated by the high correlations between the effort ratings and ratings of these physical abilities.

Recent research has shown that effort represents a combination of both cardiopulmonary (central) and muscular (local) factors. For example, it was found (Lollgen, Graham, & Sjogaard, 1980) that there was no single local or central factor that accounted for the majority of variance in effort ratings at different work loads. Furthermore, rated perceived effort did not correlate well with changes in central factors such as oxygen uptake, heart rate, and minute ventilation (Pandolf & Noble, 1973; Lollgen, Ulmer, & Nieding, 1977; Stamford & Noble, 1974) substantiating the hypothesis that effort is a complex factor that cannot be explained by any single physiological parameter. The results of the present study parallel these physiological studies, in showing that effort correlates with both strength, the local factor, and stamina, the central factor.

During the first year of this study, it was established that ratings of perceived physical effort were highly related to (1) metabolic costs and (2) specific physical abilities. Table 9 compares the effort ratings of several tasks from the first year's study (Hogan et al., 1979)

TABLE 9

## COMPARISON OF EFFORT RATINGS ON SELECTED TASKS FROM THE FIRST AND SECOND YEAR STUDIES

Second Year's Study				First Year's Study			
Task	Task List Number	Water Group	Effort Rating	Task	Task List Number	Water Group	Effort Rating
Carry 55 lb cans for 5"-54 gun staging area across deck to ladder.	12	GM	5.77	Lift and carry 70 lb box 20 ft.	21	Performance	5.65
One person load 15 5-gallon cans (55 lb) of paint into storage bins (height = 3 to 5 ft).	9	BM	5.30	Reach up and lower a 50 lb box from a 5 ft high cabinet.	7	Common Task	5.18
Take P-250 pump (147 lb) down one deck to flooded area (2 people).	15	HT	5.16	Lift and carry 70 lb box 15 ft.	20	Performance	5.25
Breakout ammo from magazine and take up two decks to ready service locker.	20	BM	4.75	Lift and carry 70 lb box 20 ft.	21	Performance	5.65
Haul mooring line back aboard ship with 6 people.	7	BM	4.60	Carry boxes of ammunition.	20	Common Task	4.70
Obtain appropriate fire extinguisher (40 lb) and/or hose and begin to fight a Class Alpha fire (50 ft).	18	BM GM HT MM	4.15 5.17 3.78 4.00	Jerk or pull ropes or cables.	14	Common Task	4.30
Remove/repair convection heaters and pressure test.	15	MM	4.18	Lift and carry a 47 lb box 20 ft.	12	Performance	3.85
Chip paint with pneumatic tool (e.g., deck crawler, knuckle buster, needle gun) for two hours.	11	BM	3.65	Assemble or repair heavy parts, such as machines, plumbing, or motors.	11	Common Task	4.50
				Sand floors with a power sander.	9	Common Task	3.80



with several from the second year's study. Although the tasks did not possess the identical wording or object moved, there were strong similarities between the common work tasks listed in the first year's study and the Navy tasks used in the second year's study. The first year's study had effort ratings on tasks that were performed in the laboratory by 20 male subjects, as well as the common work tasks rated by both males and females. The three rater groups identified in the table are (1) incumbent Navy personnel (BM, GM, HT, and MM), (2) subjects who performed the box lifting tasks in the first year's study (performance raters), and (3) untrained male and female raters who during the first year's study rated a variety of common work tasks with known metabolic costs (common task raters). For example, the GM effort rating for carrying munitions for a 5"-54 gun from the staging area across the deck to a ladder was 5.77. Lifting and carrying a 70 pound box 20 feet was given a 5.65 effort rating by the subjects who participated in the laboratory experiment. A 5"-54 projectile weighs 72 pounds and was therefore equivalent to the 70 pound box. This rating was classified as requiring a high amount (above "5") of physical effort by both groups. Similarly high effort ratings on parallel tasks were also found for HT task #15 and BM task #9 (Table 9).

Several second year study tasks requiring a medium amount (3.0-4.9) of physical effort were also found to be analogous to tasks either rated and/or performed and rated in the first year's study. Operating a pneumatic chipper (BM task #11) was similar to the common work task of sanding floors with a power sander. The BM effort rating was 3.65 while the common task rater group mean was 3.80. Both tasks require the guiding of a vibrating machine for an extended time period. Another common task that was analogous to a Navy task was jerk or pull on cables. The BM performance of hauling in the mooring lines used the same type of hand over hand motion that would be used to pull on cables. The effort ratings of 4.3 and 4.6, respectively, by the two rater groups confirmed this similarity.

The results of the first year's research demonstrated that the index of physical effort was a reliable and valid index for predicting

the work costs in a variety of tasks. When selected first year tasks were compared with Navy tasks involving comparable work behaviors, the ratings of physical effort were found to be similar. These similar effort ratings indicate that job incumbents and supervisors are able to reliably use the index of physical effort to discriminate between tasks with high, medium, and low physical demands. The first year's research established the high relationships between ratings of physical effort and the metabolic and ergonomic costs of performing different physical tasks. The present results support these findings when such ratings of physical effort are obtained from job incumbents and supervisors. Therefore, the effort index can be used as a means to classify and rank order Navy jobs according to the physical demands involved in job performance. This classification system would provide a framework for the development of personnel selection and training procedures, for clusters of Navy jobs having common physical demands, and in turn would lead to the development of physical performance standards in Navy jobs.

## REFERENCES

- Allen, P.D. & Pandolf, K.B. Perceived exertion associated with breathing hyperoxic mixtures during submaximal work. Medicine and Science in Sports and Exercise, 1977, 9, 122-127.
- Asmussen, D., Hansen, O., & Lammert, O. The relation between isometric and dynamic muscle strength in man. Communications from Danish National Association for Infantile Paralysis, 1965 20, 1-11.
- Borchart, J.W. A cluster analysis of static strength tests. Research Quarterly, 1968, 39, 258-261.
- Borg, G. Physical performance and perceived exertion. Lund, Sweden: Gleerup, 1962.
- Borg, G. Simple rating methods for estimation of perceived exertion. In G. Borg (Ed.), Physical Work and Effort, Oxford: Pergamon Press, 1977, 39-47.
- Borg, G. & Dahlstrom, H. The perception of muscular work. Umea Vetenskapliga Bibliotek Skriftserie, 1960, 5, 1-26.
- Borg, G. & Linderholm, H. Perceived exertion and pulse rate during graded exercise in various age groups. Acta Medica Scandinavica, 1967, 472, 194-204.
- Borg, G. & Noble, B.J. Perceived exertion. In J.H. Wilmore (Ed.), Exercise and sport sciences review (Vol. 2). New York: Academic Press, 1974.
- Cafarelli, E. Peripheral and central inputs to the effort sense during cycling exercise. European Journal of Applied Physiology and Occupational Physiology, 1977, 37, 181-189.
- Cafarelli, E. & Noble, B.J. The effect of inspired carbon dioxide on subjective estimates of exertion during exercise. Ergonomics, 1976, 19, 581-589.
- Cain, W.S. Nature of perceived effort and fatigue: Roles of strength and blood flow in muscle contractions. Journal of Motor Behavior, 1973, 5, 33-47.
- Cain, W.S. & Stevens, J.C. Effort in sustained and phasic handgrip contractions. American Journal of Psychology, 1971, 84, 52-65.

- Edwards, R.H.T., Melcher, A., Hesser, C.M., Wigertz, O., & Ekelund, L.G. Physiological correlates of perceived exertion in continuous and intermittent exercise with the same average power output. European Journal of Clinical Investigation, 1972, 2, 108-114.
- Fleishman, E.A. & Gebhardt, D.L. Physical abilities analysis manual, Form D. Washington, D.C.: Advanced Research Resources Organization, 1979.
- Fleishman, E.A. & Hogan, J.C. A taxonomic method for assessing the physical requirements of jobs: The physical abilities analysis approach. (Tech. Rep. R78-6). Washington, D.C.: Advanced Research Resources Organization, June 1978.
- Gamberale, F. Perceived exertion, heart rate, oxygen uptake and blood lactate in different work operations. Ergonomics, 1972, 15, 545-554.
- Ghiselli, E.E. Theory of psychological measurement. New York: McGraw-Hill, Inc., 1964.
- Hogan, J.C. and Fleishman, E.A. An index of the physical effort required in human task performance. Journal of Applied Psychology, 1979, 64, 197-204.
- Hogan, J.C., Jennings, M.C., Ogden, G.D., & Fleishman, E.A. Determining the physical requirements of Exxon apprentice jobs: Job analysis and test development. Washington, D.C.: Advanced Research Resources Organization, 1980.
- Hogan, J.C., Ogden, G.D., Gebhardt, D.L., & Fleishman, E.A. Methods for evaluation of the physical and effort requirements of Navy tasks; Metabolic, performance and physical ability correlates of perceived effort. Washington, D.C.: Advanced Research Resources Organization, 1979.
- Hogan, J.C., Ogden, G.D., Gebhardt, D.L., & Fleishman, E.A. Reliability and validity of methods for evaluating perceived physical effort. Journal of Applied Psychology, 1980, 65, 672-679.
- Hogan, J.C., Ogden, G.D., & Fleishman, E.A. Assessing physical requirements for establishing medical standards in selected benchmark jobs. Washington, D.C.: Advanced Research Resources Organization, 1978.
- Hogan, J.C., Ogden, G.D., & Fleishman, E.A. The development and validation of tests for order selector job in warehousing. Washington, D.C.: Advanced Research Resources Organization, 1979.
- Laubach, I.L. Comparative muscular strength of men and women: A review of the literature. Aviation, Space, and Environmental Medicine, 1976, 47, 534-542.

- Lollgen, H., Graham, T., & Sjogaard, G. Muscle metabolites, force and perceived exertion bicycling at varying pedal rates. Medicine and Science in Sports and Exercise, 1980, 12, 345-351.
- Lollgen, H., Ulmer, H.V., & Nieding, G.V. Heart rate and perceptual response to exercise with different pedalling speed in normal subjects and patients. European Journal of Applied Physiology, 1977, 37, 297-304.
- Myers, D.C., Gebhardt, D.L., & Fleishman, E.A. Development of physical performance standards for army jobs. Washington, D.C.: Advanced Research Resources Organization, 1979.
- Noble, B.J. & Borg, G. Perceived exertion during walking and running. In R. Piret (Ed.), Proceedings of the 17th International Congress of Applied Psychology, Brussels, 1972, 387-392.
- Pandolf, K.B. Psychological and physiological factors influencing perceived exertion. In G.A.V. Borg (Ed.), Physical work and effort. Oxford: Pergamon, 1977, 371-383.
- Pandolf, K.B. Influences of local and central factors in dominating rated perceived exertion during physical work. Perceptual and Motor Skills, 1978, 46, 683-698.
- Pandolf, K.B. & Noble, B.J. The effect of pedalling speed and resistance changes on perceived exertion for equivalent power outputs on the bicycle ergometer. Medicine and Science in Sports, 1973, 5, 132-136.
- Shrout, P.E. & Fleiss, J.L. Intraclass correlations: Uses in assessing rater reliability. Psychological Bulletin, 1979, 86, No. 2, 420-428.
- Stamford, B.A. Validity and reliability of subjective ratings of perceived exertion during work. Ergonomics, 1976, 19, 53-60.
- Stamford, B.A. & Noble, B.J. Metabolic cost and perception of effort during bicycle ergometer work performance. Medicine and Science in Sports, 1974, 6, 226-231.
- Theologus, G.C., Romashko, T., & Fleishman, E.A. Development of a taxonomy of human performance: A feasibility study of ability dimensions for classifying human tasks. JSAS Catalog of Selected Documents in Psychology, American Psychological Association, 1973, 3, 15-26.
- Wardle, M.G. A psychophysical approach to estimating endurance in performing physically demanding work. Human Factors, 1978, 20, 745-747.

APPENDIX A

INSTRUCTION FOR SUPERVISORS

## DIRECTIONS FOR TASK REQUIREMENTS

The second set of task ratings we are asking you to make involves the criticality of the task. Because people vary in their capabilities, there are some tasks that anyone who is available will be able to perform. Other tasks are difficult enough that only some of the available people have the capability to perform them without taking an excessive amount of time and/or requiring a great deal of special assistance. For each major task and subtask, rate the proportions of people in your Rate who can be counted upon to perform it successfully.

Read the task requirements scale and keep it handy as you make your judgments. Then read the major task and its subtasks. Use the examples on the scale by asking these questions, "Can anyone perform this task because the time limitations are not severe and/or because all of the people available are able to handle it? Or, can about half of the people perform it because of some time limitations and/or because only half of the people available are able to handle it? Or, can only a few perform it because of severe time limitations and/or because only a few of the people available are able to handle it?" Now pick one number from 7 to 1 that you think best describes the proportions of people in your Rate who can be counted on to perform the task successfully. Write it in the space provided next to the task for both auxiliary and combat ships.

### DIRECTIONS FOR FREQUENCY RATINGS

The first set of task ratings we are asking you to make is frequency ratings. Please read the frequency scale carefully and keep it handy as you make your judgments. Read the numbered major task and the subtasks involved in the task. Think about how frequently this task is performed and read the examples on the scale. Use these examples by asking the question, "Is this performed more frequently, the same, or less frequently than the example on the scale?" Now pick one number on the scale from 7 to 1 that you think is the frequency with which the whole task is performed. Write it in the space provided next to the major task only. If the frequency with which the task is performed falls somewhere between two numbers on the scale, pick the number which is closest to being correct.

Remember to rate the frequency of the major task for both auxiliary and combat ships.



### DIRECTIONS FOR IMPORTANCE RATINGS

The third set of task ratings we are asking you to make is importance ratings. Please read the importance scale and keep it handy as you make your judgments. Think about how important it is to perform the task correctly. Tasks that are not critical are those where incorrect performance will not lead to equipment breakdown or damage. Read the major task and all the steps or subtasks that are involved in performing that task. Then look at the first subtask. Think of this subtask as it is performed in the context of the major task. Now pick one number from 7 to 1 that you think best describes importance of the subtask to the major task. Continue to rate each subtask in the same manner and then rate the major task on its overall importance in your Rate. Remember to rate the major tasks and the subtasks for both the auxiliary and combat ships.

## DIRECTIONS FOR PHYSICAL EFFORT RATINGS

The last set of task ratings we are asking you to make is physical effort ratings. Read the physical effort scale and keep it handy as you make your judgments. Read the major task and all the steps or subtasks that are involved in performing that task. Then look at the first subtask. Think of this subtask as it is performed in the context of the major task, and rate this subtask, relative to all possible work ranging from extremely easy to extremely hard in terms of physical effort. Use the examples on the scale by asking the question, "Is this subtask as hard or harder than operating a jack hammer, or as easy as sitting at a desk using a hand calculator?" Now pick one number on the scale from 7 to 1 that you think best describes the degree of physical demand experienced in performing that subtask. Continue to rate each subtask in the same manner and then think about the major task. Select the one number that you think best describes the degree of physical demand experienced in performing the major task and write it in the space provided. Remember to rate the major tasks and the subtasks for both auxiliary and combat ships.

## DIRECTIONS FOR PHYSICAL EFFORT RATINGS

The last set of task ratings we are asking you to make is physical effort ratings. Read the physical effort scale and keep it handy as you make your judgments. Read the major task and all the steps or subtasks that are involved in performing that task. Then look at the first subtask. Think of this subtask as it is performed in the context of the major task, and rate this subtask, relative to all possible work ranging from extremely easy to extremely hard in terms of physical effort. Use the examples on the scale by asking the question, "Is this subtask as hard or harder than operating a jack hammer, or as easy as sitting at a desk using a hand calculator?" Now pick one number on the scale from 7 to 1 that you think best describes the degree of physical demand experienced in performing that subtask. Continue to rate each subtask in the same manner and then think about the major task. Select the one number that you think best describes the degree of physical demand experienced in performing the major task and write it in the space provided. Remember to rate the major tasks and the subtasks for both auxiliary and combat ships.

APPENDIX B

SUPERVISOR RATING FORMS

# GUNNER'S MATE

## FREQUENCY

Type of ship:

AUXILIARY

COMBAT

- |     |       |       |
|-----|-------|-------|
| 1.  | _____ | _____ |
| 2.  | _____ | _____ |
| 3.  | _____ | _____ |
| 4.  | _____ | _____ |
| 5.  | _____ | _____ |
| 6.  | _____ | _____ |
| 7.  | _____ | _____ |
| 8.  | _____ | _____ |
| 9.  | _____ | _____ |
| 10. | _____ | _____ |
| 11. | _____ | _____ |
| 12. | _____ | _____ |
| 13. | _____ | _____ |
| 14. | _____ | _____ |
| 15. | _____ | _____ |
| 16. | _____ | _____ |
| 17. | _____ | _____ |
| 18. | _____ | _____ |
| 19. | _____ | _____ |
| 20. | _____ | _____ |

**GUNNER'S MATE**  
**TASK REQUIREMENTS**

Type of ship:

	<u>AUXILIARY</u>	<u>COMBAT</u>
1.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
e.	_____	_____
f.	_____	_____
2.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
3.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
4.	_____	_____
5.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
6.	_____	_____
7.	_____	_____

Gunner's Mate - Task Requirements - Page 2

Type of ship:	<u>AUXILIARY</u>	<u>COMBAT</u>
8.	_____	_____
a.	_____	_____
b.	_____	_____
9.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
10.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
11.	_____	_____
a.	_____	_____
b.	_____	_____
12.	_____	_____
13.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
e.	_____	_____
f.	_____	_____
g.	_____	_____
h.	_____	_____

Gunner's Mate - Task Requirements - Page 3

Type of ship:

AUXILIARY

COMBAT

14.

\_\_\_\_\_

\_\_\_\_\_

a.

\_\_\_\_\_

\_\_\_\_\_

b.

\_\_\_\_\_

\_\_\_\_\_

c.

\_\_\_\_\_

\_\_\_\_\_

d.

\_\_\_\_\_

\_\_\_\_\_

15.

\_\_\_\_\_

\_\_\_\_\_

a.

\_\_\_\_\_

\_\_\_\_\_

b.

\_\_\_\_\_

\_\_\_\_\_

c.

\_\_\_\_\_

\_\_\_\_\_

d.

\_\_\_\_\_

\_\_\_\_\_

e.

\_\_\_\_\_

\_\_\_\_\_

16.

\_\_\_\_\_

\_\_\_\_\_

17.

\_\_\_\_\_

\_\_\_\_\_

a.

\_\_\_\_\_

\_\_\_\_\_

b.

\_\_\_\_\_

\_\_\_\_\_

18.

\_\_\_\_\_

\_\_\_\_\_

a.

\_\_\_\_\_

\_\_\_\_\_

b.

\_\_\_\_\_

\_\_\_\_\_

c.

\_\_\_\_\_

\_\_\_\_\_

19.

\_\_\_\_\_

\_\_\_\_\_

a.

\_\_\_\_\_

\_\_\_\_\_

b.

\_\_\_\_\_

\_\_\_\_\_

c.

\_\_\_\_\_

\_\_\_\_\_

d.

\_\_\_\_\_

\_\_\_\_\_

e.

\_\_\_\_\_

\_\_\_\_\_



Gunner's Mate - Task Requirements - Page 4

Type of ship:

AUXILIARY

COMBAT

20.

a.

b.

c.

d.

e.

GUNNERS'S MATE  
EFFORT RATINGS

Type of ship:

	<u>AUXILIARY</u>	<u>COMBAT</u>
1.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
e.	_____	_____
f.	_____	_____
2.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
3.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
4.	_____	_____
5.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
6.	_____	_____
7.	_____	_____

Gunner's Mate - Effort Ratings - Page 2

Type of ship:

	<u>AUXILIARY</u>	<u>COMBAT</u>
8.	_____	_____
a.	_____	_____
b.	_____	_____
9.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
10.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
11.	_____	_____
a.	_____	_____
b.	_____	_____
12.	_____	_____
13.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
e.	_____	_____
f.	_____	_____
g.	_____	_____
h.	_____	_____

Gunner's Mate - Effort Ratings - Page 3

Type of ship:

AUXILIARY

COMBAT

14.

a.

b.

c.

d.

15.

a.

b.

c.

d.

e.

16.

17.

a.

b.

18.

a.

b.

c.

19.

a.

b.

c.

d.

e.

Gunner's Mate - Effort Ratings - Page 4

Type of ship:

AUXILIARY

COMBAT

20.

a.

b.

c.

d.

e.

GUNNER'S MATE  
TASK IMPORTANCE TO JOB

Type of ship:

	<u>AUXILIARY</u>	<u>COMBAT</u>
1.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
e.	_____	_____
f.	_____	_____
2.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
3.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____
4.	_____	_____
5.	_____	_____
a.	_____	_____
b.	_____	_____
c.	_____	_____
6.	_____	_____
7.	_____	_____

Gunner's Mate - Task Importance to Job - Page 2

Type of ship:

AUXILIARY

COMBAT

- |     |       |       |
|-----|-------|-------|
| 8.  | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| 9.  | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| c.  | _____ | _____ |
| d.  | _____ | _____ |
| 10. | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| c.  | _____ | _____ |
| d.  | _____ | _____ |
| 11. | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| 12. | _____ | _____ |
| 13. | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| c.  | _____ | _____ |
| d.  | _____ | _____ |
| e.  | _____ | _____ |
| f.  | _____ | _____ |
| g.  | _____ | _____ |
| h.  | _____ | _____ |

Gunner's Mate - Task Importance to Job - Page 3

Type of ship:

AUXILIARY

COMBAT

- |     |       |       |
|-----|-------|-------|
| 14. | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| c.  | _____ | _____ |
| d.  | _____ | _____ |
| 15. | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| c.  | _____ | _____ |
| d.  | _____ | _____ |
| e.  | _____ | _____ |
| 16. | _____ | _____ |
| 17. | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| 18. | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| c.  | _____ | _____ |
| 19. | _____ | _____ |
| a.  | _____ | _____ |
| b.  | _____ | _____ |
| c.  | _____ | _____ |
| d.  | _____ | _____ |
| e.  | _____ | _____ |



Gunner's Mate - Task Importance to Job - Page 4

Type of ship:

AUXILIARY

COMBAT

20.

a.

b.

c.

d.

e.

APPENDIX C

RESULTS OF CRITICALITY RATINGS

APPENDIX C

RESULTS OF CRITICALITY RATINGS

TABLE C

Summary of Criticality Ratings on Each Scale by Major Tasks for Frequency  
and by Major and Sub-Tasks for Task Requirements, Task Importance and Effort

Task List: Machinist Mate

Task List	Frequency		Task Requirements		Task Importance		Effort	
	X	S.D.	X	S.D.	X	S.D.	X	S.D.
1. Remove and replace relief valve on auxiliary steam boiler (50 - 60#).	1.6	.6	2.9	1.8	6.2	1.0	4.7	.9
a. Secure system in accordance with current safety directives/ instructions and tag out procedures.			1.9	1.0	6.4	1.6	2.2	1.1
b. Unbolt valve from flanges using appropriate tools.			2.0	.7	4.1	2.1	3.8	.6
c. Use slugging wrench if necessary.			2.1	.9	3.8	2.0	4.9	.1
d. Pry pipes apart as necessary to remove valve.			2.0	.8	4.2	1.8	4.5	1.2
e. Lower valve to deck, using come-along or chainfall.			2.0	.9	4.4	2.1	4.1	1.1
f. Send to shop for repair.			2.4	1.4	3.6	2.2	3.1	1.6
g. Replace overhauled valve.			2.6	1.0	5.5	1.8	4.6	.9
h. Bolt valve to flanges.			2.0	.7	5.8	1.6	4.0	1.1
i. Untag system and test-operate boiler.			3.5	1.7	6.4	1.2	2.5	1.5
j. Test and set safety as necessary for proper operation.			4.0	1.6	6.7	.9	3.0	1.4
2. Remove auxiliary circulating pump from underneath evaporator.	1.7	.6	2.7	.9	6.0	.9	5.2	1.2
a. Crawl under evaporator with hand tools.			1.8	1.0	3.4	2.2	3.1	1.3
b. Unbolt pump and disconnect flex coupling from motor.			2.0	1.1	4.8	1.9	3.7	1.2
c. Push and pull pump out from under evaporator.			2.6	1.1	4.2	2.0	5.1	1.0
d. Make necessary repairs, replace bearing and wearing rings, and perform PMS.			3.3	1.4	6.3	.8	4.0	.9
e. Reposition pump on foundation, reinstall fastener, and align with piping.			3.2	1.3	6.3	.7	5.0	1.0
f. Roll/rotate pump by hand.			1.9	1.0	5.1	1.8	2.6	.9
g. Bolt piping and foundation.			1.9	1.0	5.8	1.4	3.6	.8
h. Adjust packing gland.			2.2	1.6	5.9	1.1	2.3	.9
3. Remove main drain valve from bilges (150#).	1.8	1.0	2.5	1.1	5.1	1.7	5.0	1.1
a. Remove interference as required (deck plate, etc.).			2.1	1.3	4.0	1.7	3.5	1.2
b. Rig come-along.			2.0	.9	4.5	2.1	3.6	1.0
c. Crawl down into bilge.			1.8	1.0	3.7	2.1	2.6	1.3
d. Unbolt valve flanges.			1.9	1.0	4.4	2.1	3.8	1.3
e. Use slugging wrench if necessary.			2.1	1.0	3.7	2.1	4.6	1.1
f. Rig out valve.			2.7	1.0	4.4	1.9	4.2	1.1
g. Deliver valve to repair facility (e.g., tender, SIMA) or if done on board ship refer to (h) and (i).			3.1	1.6	3.4	2.2	3.6	1.5
h. Repair or replace parts as necessary.			3.1	1.7	6.0	1.4	3.1	1.0
i. Clean all parts.			1.7	.9	4.8	2.1	1.9	.7
j. Rig valve for replacement in bilge.			2.4	.8	4.8	1.7	4.0	1.2
k. Lower valve into bilge.			2.3	1.1	4.5	1.9	4.0	1.3
l. Position valve.			2.5	1.2	5.5	1.6	4.3	1.1
m. Bolt valve in place.			1.9	1.2	5.8	1.4	4.3	1.2
n. Replace interference.			2.0	1.1	4.5	1.9	5.5	1.3

TABLE C (Continued)

Task List: Machinist Mate

Task List	Frequency		Task Requirements		Task Importance		Effort	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
4. Replace 48" flywheel on MP air compressor.	1.4	.7	3.4	1.4	5.5	1.8	5.5	1.3
a. Bring down one deck with come-along and chainfall to engine room.			3.0	1.2	4.9	1.8	4.9	1.5
b. Roll through passage way and around other equipment as necessary.			2.5	1.1	4.4	1.9	4.8	1.4
c. Remove all interference to have clear passage from ladder to compressor.			2.5	.9	4.0	1.9	4.1	1.0
d. Rig and rerig come-along and chainfalls at one end of compressor in order to raise flywheel and pass it to other end of compressor. Use existing padeyes and I-clamps.			3.0	1.3	5.3	1.6	4.8	1.3
e. Lower flywheel into place.			2.8	1.2	5.5	1.6	4.4	1.3
f. Position flywheel for appropriate replacement.			3.2	1.4	5.9	1.5	4.4	1.1
g. Put motor back in place and realign it.			3.9	1.7	6.7	1.1	5.1	1.0
h. Attach hardware and reassemble the equipment.			3.1	1.4	6.0	1.4	4.2	.9
5. Perform maintenance on MP air compressor.	2.6	1.3	3.4	1.5	6.4	1.0	4.8	1.2
a. Rig chainfall to fixed padeye.			2.2	.8	5.0	1.6	4.0	1.0
b. Remove head.			2.9	1.2	5.5	1.5	4.0	.8
c. Remove casing.			3.0	1.2	5.6	1.5	4.3	.9
d. Remove cylinder liner to replace piston.			3.3	1.6	5.6	1.6	4.2	.9
e. Replace valves.			3.0	1.5	5.7	1.4	3.3	1.2
f. Install new gaskets and "O" rings.			2.8	1.3	5.9	1.2	2.7	1.3
g. Replace liner, piston, and head assembly.			3.8	1.5	6.3	1.1	4.4	1.0
6. Perform PMS on air ejector.	2.2	.8	2.7	.9	5.8	1.2	3.8	1.4
a. Remove interference.			2.0	.9	4.1	1.8	3.6	1.3
b. Remove block cover.			2.2	1.0	4.9	1.7	4.0	1.0
c. Remove air ejector steam nozzle.			2.9	1.3	5.6	1.4	3.9	1.1
d. Clean/replace nozzle as necessary.			3.0	1.5	5.9	1.2	3.1	1.1
e. Install nozzle, block cover and interference.			2.9	1.1	6.0	1.1	3.9	1.1
7. Repair auxiliary circulating pump.	2.0	1.0	2.9	1.0	6.0	1.3	5.0	1.7
a. Receive pump in shop (or on tender).			2.4	1.5	2.8	2.1	3.1	1.6
b. Unbolt casing.			2.1	.9	3.6	2.2	3.9	1.0
c. Rig to remove casing cover.			2.5	.9	4.4	1.8	3.7	.9
d. Disassemble.			2.7	1.0	5.3	1.6	3.8	.9
e. Sandblast to clean off.			2.0	.8	3.7	2.3	3.0	.9
f. Paint with appropriate paint.			1.7	.7	3.1	2.0	2.0	.8
g. Repair/replace defective parts (e.g., casing, impeller wearing rings, bearings, sleeves and packing glands as necessary).			3.2	1.5	6.4	.8	4.0	1.0
h. Lift rotating assembly back in place (2 - 3 people).			2.8	1.2	6.1	1.2	4.9	1.2
i. Replace casing cover.			2.7	1.3	5.9	1.1	4.6	1.2
j. Pressure test (hydrostatically pressure test).			3.1	1.8	6.1	1.1	3.2	1.3

TABLE C (Continued)

Task List: Machinist Mate

<u>Task List</u>	<u>Frequency</u>		<u>Task Requirements</u>		<u>Task Importance</u>		<u>Effort</u>	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
8. Perform maintenance on small pump (e.g., small craft).	3.4	1.4	2.0	1.1	6.2	.9	3.1	1.4
a. Check oil in gearbox.			1.7	.9	6.0	1.1	1.9	.8
b. Change or clean filters.			1.8	.8	5.6	1.1	2.6	1.0
c. Check bearings.			2.2	1.1	6.0	1.0	2.2	.9
9. Overhaul lube oil purifiers.	1.8	1.0	3.3	1.6	6.4	.9	4.2	1.3
a. Disassemble.			2.6	1.2	5.6	1.4	4.1	1.2
b. Check for worn parts and repair or replace as necessary.			3.2	1.5	6.3	.9	3.0	1.2
c. Reassemble.			3.2	1.5	6.4	.8	4.1	1.1
d. Test run.			3.1	1.5	6.3	1.1	2.6	1.1
10. Replace spring bearing (line shaft bearing) on main shaft.	1.2	.5	4.1	1.9	6.8	.5	5.9	1.2
a. Remove interference as necessary (e.g., deck plates, etc.).			2.0	1.1	4.1	1.9	4.2	1.5
b. Rig chainfall to overhead padeyes.			2.5	.9	5.3	1.3	4.6	1.1
c. Rig spring bearing cover.			2.7	1.4	5.6	1.3	4.5	1.1
d. Unbolt and remove bearing cap with chainfalls.			2.9	1.3	5.6	1.3	5.0	1.0
e. Remove oiling rings.			3.0	1.7	5.3	1.5	3.5	.7
f. Rig and remove upper half of bearing.			3.5	1.6	6.1	1.1	4.7	1.0
g. Rig jacks/chainfalls to the lower bearing half.			3.5	1.5	5.8	1.2	4.7	1.0
h. Roll out old bearing.			3.7	1.6	6.0	1.0	5.4	1.2
i. Rig new bearing in place.			3.8	1.8	6.5	.7	5.3	1.0
j. Roll in new bearing.			3.7	1.6	6.6	.5	5.3	1.3
k. After bluing, roll bearing out.			4.0	1.7	6.4	.8	5.4	1.0
l. Scrape bearing as necessary.			4.0	1.9	6.6	.9	3.5	1.1
m. Repeat steps (j), (k), and (l) until desired surface is obtained.			4.0	1.6	6.5	1.0	5.4	1.1
n. Lower shaft into place.			3.7	1.9	6.2	1.6	4.4	1.1
o. Replace and bolt spring bearing cover.			3.0	1.5	5.8	1.3	4.8	1.0
p. Replace interference as necessary.			2.2	1.1	4.9	1.7	4.3	1.3
q. Restow all equipment.			1.9	.9	4.1	2.0	3.5	1.4
11. Remove convection heaters and pressure test.	1.6	.7	2.7	1.1	4.5	1.9	4.5	1.0
a. Remove heater and deliver to repair facility.			2.3	1.1	4.0	1.9	4.3	1.1
b. Pick up heater when complete and reinstall.			2.3	1.0	4.5	2.0	4.2	1.2
12. Make repairs to package conveyor.	1.9	1.0	3.7	1.4	4.5	1.8	4.6	1.1
13. Pry flywheel off of an air compressor while in shop area.	2.4	1.7	3.1	1.5	5.0	1.6	5.4	1.0
14. Use slugging wrench and sledge hammer on steam valve 4"nut located overhead.	2.4	1.1	2.7	1.2	4.9	1.6	5.9	.9
15. Clean mud drum on boiler.	1.8	.7	2.8	1.6	5.6	2.0	5.3	1.3
a. Tag out system in accordance with current directives.			2.1	1.2	6.8	.8	2.1	1.3
b. Unbolt manhole cover.			1.8	.9	4.1	2.0	4.1	1.0
c. Lift off manhole cover and set aside.			2.1	1.1	3.5	2.2	4.8	.9
d. Remove interference as necessary.			2.3	1.3	3.1	1.9	4.1	1.1
e. Climb into mud drum.			1.6	.7	3.4	2.2	3.1	1.5
f. Clean dirt, debris from inside with scrapers.			1.8	.9	4.5	2.1	3.9	1.
g. Replace interference.			2.4	1.5	4.2	2.3	3.9	1.1
h. Lift manhole cover back into place.			2.2	1.1	4.9	2.0	4.7	1.1
i. Bolt down manhole cover.			2.1	1.3	5.2	2.2	4.3	1.1

TABLE C (Continued)  
Task List: Machinist Mate

Task List	Frequency		Task Requirements		Task Importance		Effort	
	X	S.D.	X	S.D.	X	S.D.	X	S.D.
16. Water lance tubes in boiler.	1.7	.6	3.2	1.8	5.5	1.9	4.9	1.2
a. Remove interference and open steam drum.			2.6	1.5	4.4	2.2	4.3	1.2
b. Remove boiler internals (e.g., cyclone separators, scrubbers, aprons, surface blowline).			3.1	1.5	4.6	2.0	5.1	1.0
c. Remove hand hole covers.			2.2	1.1	4.4	2.2	4.5	.9
d. Rig and use water lancer.			2.9	1.8	4.8	2.1	4.6	1.2
e. Replace hand hole covers.			2.2	1.1	4.8	2.4	4.4	1.2
f. Replace boiler internals.			3.3	1.7	5.4	2.1	4.8	1.1
g. Close steam drum and replace interference.			2.9	1.4	5.1	2.3	4.4	1.0
17. Do sounding check on mounting bolts (PMS A9).	2.7	1.0	1.5	1.0	4.7	1.7	2.7	1.1
18. Chip paint for one hour with pneumatic tool.	3.5	1.3	1.4	.6	2.9	1.7	3.4	1.4
19. Paint area previously chipped.	3.7	1.3	1.4	.6	3.6	2.1	2.5	1.0
20. Carry tool bag (35#) to work area.	5.1	.3	1.3	.6	4.0	2.1	3.0	1.1
21. Carry 5 gallon cans of freon to large air conditioning unit (2 men, 150#).	2.7	.9	2.0	1.0	4.4	1.9	4.8	1.1
22. Carry freon bottles to refrigeration units (84# - 1 man) for recharging, as necessary.	3.0	1.2	2.4	1.2	4.7	2.0	5.1	1.1
23. VEPTREP of stores with a cargo net and pallets (greater than 2,000 lbs.; 1 helo per 8 loads).	2.8	1.3	2.5	1.4	4.8	2.0	5.0	1.3
<u>Delivery ship</u>								
a. Lay out cargo nets for receiving pallets from forklift.			2.1	1.2	4.3	2.2	3.8	1.3
b. Attach becket and hoisting sling to the net and then to the safety hook.			2.4	1.5	4.7	2.0	3.4	1.1
<u>Receiving ship</u>								
c. Release cargo hook from helo.			2.6	1.5	4.4	2.4	2.8	1.3
d. After helo has departed, release pendant hook and open net.			2.3	1.2	4.0	2.2	3.0	1.3
e. Cut banding on load.			2.1	1.1	3.8	2.0	3.1	1.5
f. Pick up cargo, remove from drop zone, and place in the staging area.			2.1	1.0	3.9	1.8	4.8	1.3
g. Pick up empty pallet and pendant, and place in staging area.			2.2	1.2	3.7	1.7	4.3	1.2
h. Assemble 6 - 8 pallets, nets, and retrograde on drop zone for return to UNREP ship.			2.4	1.3	3.8	2.0	4.5	1.4
24. Onload munitions for 5" - 54 guns (1,200 pieces).	2.5	1.2	2.5	1.3	5.8	2.0	5.2	1.4
a. Carry ammo across deck to ladder.			2.4	1.4	5.4	2.0	5.2	1.2
b. Pass ammo by hand down two decks to the magazine.			2.3	1.5	5.4	2.0	5.0	1.6
c. Use ammo hoist to lower ammo to magazine deck if available.			2.6	1.6	5.1	2.1	3.8	1.5
d. Place powder in bins.			2.8	1.7	5.3	2.0	4.8	1.3
e. Place projectiles in racks.			2.8	1.6	5.3	2.1	5.3	1.3
25. Unload/stage cargo on a receiving ship.	2.8	1.2	2.4	1.2	4.5	2.0	5.2	1.2
a. Breakdown pallet after it has been moved to unloading area.			2.3	1.5	3.1	1.6	4.6	1.2
b. Break bands and take off stores.			2.3	1.3	3.1	1.7	4.1	1.5
c. Carry stores across the deck (e.g., frozen chicken, milk, potatoes, etc.).			2.0	1.2	3.2	1.8	5.0	1.4
d. Pass stores down several decks to storage area (e.g., reefer deck).			2.1	1.1	3.5	2.0	5.1	1.4
e. Place stores in bins (e.g., reefers).			2.3	1.3	3.6	2.0	4.7	1.3

TABLE C (Continued)

Task List: Machinist Mate

<u>Task List</u>	<u>Frequency</u>		<u>Task Requirements</u>		<u>Task Importance</u>		<u>Effort</u>	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
26. Secure hatch in a flooded compartment.	1.5	1.4	2.2	1.2	6.9	.2	5.2	1.3
27. Open and close non-counter balanced scuttles in the overhead.	4.0	1.5	2.1	.9	5.6	1.7	4.6	1.3
a. Turn handle to open position.			1.6	.7	5.2	2.0	3.3	1.0
b. Push hatch straight up until it locks in open position.			1.9	.8	5.4	2.0	4.2	1.5
28. Take initial action on a Class Alpha fire.	2.5	1.4	1.9	.9	6.9	.4	3.7	1.8
a. Report fire.			1.4	.6	5.9	.2	2.3	1.7
b. Sound alarm.			1.5	.8	5.9	.2	2.3	1.6
c. Obtain appropriate fire extinguisher and begin to fight fire.			2.0	.9	5.9	.2	4.0	1.6
29. Control ruptured LP water pipeline.	1.3	1.2	2.3	1.0	6.6	1.1	4.4	1.5
a. Report problem.			1.6	.9	6.7	.7	2.2	1.3
b. Secure system.			2.2	1.0	6.8	.4	3.1	.9
c. Put in soft patch by placing rag on wood stick and jamming into ruptured area.			2.9	1.3	6.0	1.5	3.7	1.2
d. Saw off wood and place 1/8" rubber sheet over area.			2.5	1.3	5.7	1.7	3.5	1.1
e. Wrap patch with marlin.			2.5	1.3	5.7	1.6	3.3	1.1
30. Patch a small hole in the bulkhead to retain incoming sea water.	1.1	.5	2.8	1.4	6.8	.6	4.8	1.2
a. Plug the hole with a piece of soft wood.			2.5	1.3	6.7	.7	4.4	1.3
b. Work oakum or rags into the hole with a maul.			2.5	1.4	6.5	.8	4.2	1.4
c. Wedge smaller pieces of wood into the hole.			2.3	1.4	6.4	.9	4.0	1.4
d. Shore up the bulkhead around the hole.			2.8	1.5	5.4	1.1	4.9	1.2
e. For large holes, shore up the deck from the next lower deck.			3.1	1.7	5.8	.5	5.5	1.3



TABLE C

Summary of Criticality Ratings on Each Scale by Major Tasks for Frequency  
and by Major and Sub-Tasks for Task Requirements, Task Importance and Effort

Task List: Hull Technician

Task List	Frequency		Task Requirements		Task Importance		Effort	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
1. Removal and replacement of a 3' section of low pressure 3" pipe.	2.9	1.0	2.9	1.5	4.8	1.8	4.9	.8
a. Secure the system and isolate area.			1.9	1.4	6.6	1.2	3.0	1.1
b. Bring proper tools to area.			1.4	.5	3.8	1.6	3.2	1.7
c. Bring 15# CO <sub>2</sub> bottle to area.			1.2	.4	4.1	2.2	3.7	1.4
d. Bring torch and oxygen and acetylene bottles.			1.9	1.0	4.0	2.0	5.4	1.4
e. Bring nitrogen bottle, welding torch and lead to area.			2.1	1.3	3.9	1.9	5.4	1.2
f. Cut out damaged pipe with torch.			2.6	1.5	4.2	2.1	4.1	.9
g. Position new pipe section in place.			2.9	1.0	5.1	2.1	4.8	1.0
h. Tack weld pipe.			2.7	1.7	5.1	2.1	3.4	1.0
i. Arc weld pipe section.			3.1	2.2	5.6	1.8	3.6	.9
j. Remove slag and porosity with chipping hammer and wire brush.			1.9	1.7	4.8	1.7	2.5	.9
k. Inspect visually for leaks.			2.1	1.9	5.7	1.7	1.5	.7
l. Restore tools and equipment.			1.8	1.5	2.9	1.7	3.4	1.8
2. Bend 2" pipe with pipe bender.	3.9	1.1	3.0	1.7	4.3	2.0	4.1	.9
a. Put proper size "die" on the machine.			2.6	1.8	6.1	1.5	2.9	1.1
b. Lift pipe from storage locker and place on pipe bending machine.			2.3	1.7	3.6	2.4	4.5	1.0
c. Clamp pipe in place.			2.1	1.8	5.3	2.0	3.1	1.0
d. Bend pipe to degree desired.			2.9	1.9	6.1	1.2	3.2	1.4
3. Remove and replace an overhead valve for 4" diameter pipe.	3.0	1.2	3.4	1.9	5.0	2.0	6.0	1.0
a. Secure system.			2.6	2.0	6.9	.3	3.1	1.1
b. Unbolt the valve.			1.9	1.1	4.1	1.9	3.8	1.2
c. Pry pipe away from valve to allow for removal.			2.5	1.8	4.1	2.1	4.8	1.1
d. Lift valve out of place and carry to work area.			3.3	1.8	3.9	2.1	6.0	1.0
e. Repair valve problem.			3.4	1.8	6.0	1.3	3.6	1.0
f. Prepare flanges by removing old gaskets and using a wire brush on the flange.			1.8	1.3	4.6	1.2	2.8	1.0
g. Pry pipe apart to replace valve to proper space.			2.8	1.8	4.3	2.1	4.9	1.3
h. Wedge valve into space.			2.8	1.7	4.7	1.9	5.1	1.3
i. Bolt valve back to flange.			1.9	.8	5.1	2.1	3.8	1.0
j. Check visually for leaks.			1.3	.5	5.9	1.6	1.8	.8
4. Bend 5" pipe with pipe bender (3' length).	2.2	1.0	3.4	1.5	5.2	1.6	4.7	1.3
a. Put on proper "die".			2.6	1.5	6.7	6.5	4.2	1.8
b. Pull out amount needed from storage locker.			2.8	1.3	3.7	1.9	5.1	1.6
c. Rig end of needed pipe to chain hoist.			2.6	1.4	4.4	2.0	3.9	1.3
d. Cut off length needed.			2.4	1.2	5.3	2.4	3.9	1.0
e. Push rigged pipe to pipe bender.			2.1	1.0	4.3	2.2	3.9	.8
f. Clamp pipe in pipe bender and bend to desired degree.			2.9	1.5	6.7	.5	3.4	.8
5. Replace 3" flange.	3.6	1.0	2.3	1.2	5.0	1.7	4.0	1.2
a. Secure system and drain.			2.0	1.4	6.9	.3	4.6	.9
b. Rig torch, oxygen and acetylene.			1.9	.9	4.7	1.9	4.4	1.5
c. Remove bolts.			1.5	.6	3.9	2.1	4.0	1.4
d. Apply heat to flange and remove.			1.9	1.1	5.1	1.8	3.5	1.0
e. Prepare pipe end by cleaning.			1.5	.6	4.7	1.4	3.2	1.9
f. Slide on new flange.			1.4	.5	4.0	2.2	4.6	1.1

TABLE C (Continued)  
Task List: Hull Technician

Task List	Frequency		Task Requirements		Task Importance		Effort	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
5. Replace 3" flange (cont'd).								
g. Align bolt holes.			1.9	.9	5.1	1.9	3.2	1.0
h. Braze.			2.9	1.6	6.4	.8	3.5	.8
i. Insert gasket.			1.6	1.0	5.6	1.5	2.5	.9
j. Install bolts and tighten.			1.7	.9	5.4	1.8	3.4	1.2
k. Pressurize system.			1.8	1.1	5.5	1.6	2.7	1.1
l. Inspect for leaks.			1.5	.7	6.4	.9	1.9	1.0
6. Use plate shear to cut 1" plate 4' x 7'.	3.0	1.9	3.3	1.7	5.1	1.5	5.5	1.4
a. Obtain plate from stowage using overhead crane to carry to plate shear.			3.9	1.7	4.6	1.5	5.8	1.2
b. Position plate on rollers.			3.6	1.7	5.1	2.0	6.0	1.3
c. Push through machine.			3.6	1.0	4.9	2.2	5.7	1.4
d. Cut.			2.2	1.3	5.3	2.2	3.8	2.4
7. Carry Argon gas bottle to welding area (2 people).	4.1	1.1	1.9	.8	4.3	2.2	5.5	.9
8. Fabricate 18" x 24" stowage lockers for submarine out of sheet metal while aboard a tender.	3.1	1.6	2.9	1.6	3.7	2.2	4.3	.8
9. Replace duct in submarine.	2.8	1.6	2.9	1.5	4.9	1.9	4.6	1.1
a. Unbolt section of inner skin (bulkhead) for access to air ducts.			2.1	1.4	5.2	1.7	4.2	1.0
b. Remove damaged air duct.			2.1	.9	3.9	1.9	4.1	1.0
c. Take damaged duct to shop area.			1.6	.7	2.9	1.8	4.4	1.1
d. Fabricate new duct using old duct as a pattern.			2.9	1.7	5.3	1.8	4.2	1.1
e. Install new duct on submarine.			2.7	1.3	5.2	2.1	4.7	.8
f. Replace initial hull plates, bolt in and secure.			2.1	1.3	5.0	2.1	4.6	1.1
10. Patch a 1' x 2' hole in the hull of a ship.	1.9	1.1	3.4	1.5	6.3	1.0	5.3	.9
a. Carry tool bag and equipment to damaged area.			1.6	.9	3.9	1.9	4.2	1.1
b. Carry oxygen and acetylene bottles and cutting torch to damaged area (2 people).			2.1	1.1	4.4	1.7	5.6	1.0
c. Bring electric welding lead to area.			1.8	1.0	4.3	1.7	4.8	1.1
d. Lower personnel and equipment to area to be patched.			2.6	1.1	5.5	1.7	5.3	1.1
e. Lower 1/2" plate to damaged area via portable davit.			3.0	1.2	5.1	1.9	5.5	.
f. Position plate in hole.			2.9	1.0	5.8	1.6	5.1	.
g. Join the plate to the hull with a lap joint.			3.5	1.9	5.6	1.9	4.7	1.1
h. Tack weld plate.			3.0	1.5	5.8	1.7	4.1	1.1
i. Electric arc weld complete plate.			3.4	1.8	6.3	1.5	4.5	1.1
j. Use wire brush and chipper to remove slag and porosity.			2.1	1.5	5.4	1.7	3.4	1.1
11. Patch hole on submarine.	1.8	1.1	3.9	2.0	6.7	1.0	5.1	.
a. Prepare joint design--bevel 1/3" inside, 2/3" outside.			3.4	1.7	6.3	1.3	4.7	1.1
b. Cut patch to size.			3.0	1.6	5.9	2.1	4.5	1.1
c. Prepare bevel.			3.3	2.0	5.6	2.1	4.2	1.1
d. Weld dogs to hold patch.			2.9	1.5	5.2	1.9	4.3	.
e. Insert patch.			2.9	1.5	5.4	2.3	4.7	1.1
f. Have NDT check joint design.			3.3	2.7	6.4	1.6	2.6	1.1
g. Tack weld patch.			3.1	1.9	6.0	1.8	3.6	1.1
h. Grind tacks.			2.9	1.8	5.9	1.9	3.6	1.1

TABLE C (Continued)  
Task List: Hull Technician

Task List	Frequency		Task Requirements		Task Importance		Effort	
	X	S.D.	X	S.D.	X	S.D.	X	S.D.
11. Patch hole on submarine (cont'd).								
i. Run root pass.			3.3	2.1	6.4	1.5	4.2	.8
j. Perform NDT test (magnetic particle test).			4.3	2.6	6.5	1.6	3.3	1.2
k. Continue welding in accordance with approved sequence.			3.9	2.3	6.5	1.3	4.4	.7
l. Grind all starts and stops.			3.5	2.2	6.2	1.5	4.3	1.1
m. Dress final pass with straight or angle grinder.			3.5	2.0	6.1	1.3	4.5	1.7
n. Perform NDT.			4.4	2.5	6.5	1.4	3.3	1.2
12. Rig boatswains chair and lower HT over ship's side to repair hull.	2.4	1.2	3.0	1.6	5.6	1.5	4.9	1.0
13. Rig/remove compressor in order to repair a section of the bulkhead.	1.8	.9	3.5	2.0	5.1	1.5	5.4	.8
a. Carry chainfall and come-along to area.			2.7	1.2	4.1	2.1	5.6	.9
b. Rig chainfall to compressor.			3.0	1.2	5.3	1.9	4.7	1.2
c. Lift compressor with chainfall.			2.8	1.6	5.6	1.7	5.2	1.4
d. Remove interference.			2.9	1.4	5.3	1.8	4.8	1.6
e. Remove compressor via chainfall and come-along to another area.			3.1	1.2	4.9	2.0	5.7	1.1
14. Clean drains.	4.5	.6	1.6	1.1	4.3	1.9	4.1	1.1
a. Use plunger.			1.4	.7	3.4	1.9	3.4	1.0
b. Use hand snake 25'.			1.9	1.1	3.8	2.1	4.1	.9
c. Use electric snake.			2.1	1.8	4.2	1.9	4.1	1.0
15. Carry boxes of small arms ammo to magazine (2 people).	2.5	1.1	2.1	.9	5.1	1.6	4.8	1.0
a. Carry across deck.			1.9	1.0	4.9	1.8	4.7	1.2
b. Pass down two decks.			2.1	1.2	4.9	1.8	5.1	1.1
16. VEPTREP of stores with a cargo net and pallets (greater than 2,000 lbs.; 1 helo per 8 loads).	2.2	1.2	3.3	1.8	5.1	1.8	4.8	1.3
<u>Delivery ship</u>								
a. Lay out cargo nets for receiving pallets from forklift.			2.4	1.8	4.4	1.9	4.3	1.3
Attach becket and hoisting sling to the net and then to the safety hook.			2.9	1.9	5.6	1.3	3.8	1.5
<u>Receiving ship</u>								
c. Release cargo hook from helo.			2.8	1.8	5.8	1.4	3.7	1.4
d. After helo has departed, release pendant hook and open net.			2.8	1.9	4.7	2.0	3.6	1.4
e. Cut banding on load.			2.3	2.0	3.5	2.3	3.1	1.3
f. Pick up cargo, remove from drop zone, and place in the staging area.			2.7	1.7	3.5	2.3	4.6	1.3
g. Pick up empty pallet and pendant, and place in staging area.			2.3	1.5	3.1	2.5	4.3	1.1
h. Assemble 6 - 8 pallets, nets, and retrograde on drop zone for return to UNREP ship.			2.2	.8	3.5	2.3	4.7	1.9
17. Unload munitions for 5" - 54 guns (1,200 pieces).	1.8	.9	2.9	1.7	5.8	1.6	5.5	1.0
a. Carry ammo across deck to ladder.			2.3	1.6	6.1	1.4	5.2	1.3
b. Pass ammo by hand down two decks to the magazine.			2.5	1.6	6.1	1.2	5.6	1.0
c. Use ammo hoist to lower ammo to magazine deck if available.			2.3	1.2	6.1	1.3	4.4	1.6
d. Place powder in bins.			2.2	1.3	6.2	1.4	5.1	1.5
e. Place projectiles in racks			2.5	1.5	6.1	1.5	5.3	1.5

TABLE C (Continued)

Task List: Hull Technician

Task List	Frequency		Task Requirements		Task Importance		Effort	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
18. Unload/stage cargo on a receiving ship.	2.7	1.2	2.5	1.0	4.4	1.8	5.1	.9
a. Breakdown pallet after it has been moved to unloading area.			1.9	.9	3.8	2.2	4.8	1.1
b. Break bands and take off stores.			1.8	1.0	3.7	2.1	4.5	1.8
c. Carry stores across the deck (e.g., frozen chicken, milk, potatoes, etc.).			1.6	.8	3.4	2.0	5.5	1.2
d. Pass stores down several decks to storage area (e.g., reefer deck).			2.3	.9	3.4	2.3	5.8	1.1
e. Place stores in bins (e.g., reefers).			1.8	.8	3.7	2.5	5.4	1.5
19. Secure hatch in a flooded compartment.	2.0	1.6	2.7	1.3	6.9	.5	5.3	1.7
20. Open and close non-counter balanced scuttles in the overhead.	3.7	1.4	2.6	1.5	5.4	1.8	4.9	1.8
a. Turn handle to open position.			2.1	1.3	5.1	2.1	4.2	1.9
b. Push hatch straight up until it locks in open position.			2.4	1.4	6.0	1.6	4.8	1.7
21. Take initial action on a Class Alpha fire.	2.6	1.2	2.1	1.5	7.0	-	3.0	1.4
a. Report fire.			1.6	.8	6.9	.5	2.0	.9
b. Sound alarm.			1.5	.7	6.9	.5	4.6	1.0
c. Obtain appropriate fire extinguisher and/or hose and begin to fight fire.			1.8	.8	6.9	.3	4.2	1.2
22. Control ruptured LP pipeline.	2.0	1.2	2.8	1.4	6.8	.4	1.9	1.9
a. Report problem.			1.7	.9	6.6	.6	2.8	1.1
b. Secure system.			1.9	1.1	6.9	.3	3.7	.9
c. Put in soft patch by placing rag on wood stick and jamming into ruptured area.			2.6	1.6	6.3	1.1	3.6	1.1
d. Saw off wood and place 1/8" rubber sheet over area.			2.4	1.3	6.0	1.3	3.3	.9
e. Wrap patch with marlin.			2.1	1.2	5.9	1.4	4.5	.9
23. Patch a small hole in the bulkhead to retain incoming sea water.	1.1	.3	2.8	1.8	6.8	.4	3.7	1.0
a. Plug the hole with a piece of soft wood.			2.3	1.3	6.4	1.1	3.7	1.1
b. Work oakum or rags into the hole with a maul.			2.4	1.3	6.3	1.1	3.7	1.0
c. Wedge smaller pieces of wood into the hole.			2.2	1.2	6.1	1.1	3.6	1.0
d. For large holes, shore up the deck from the next lower deck.			3.3	1.5	6.4	1.0	4.8	1.3
24. Fight Class Charlie Fire	2.8	1.1	1.9	1.1	6.8	.5	4.8	1.0
a. Report fire.			1.4	.6	6.8	.8	1.8	1.2
b. Sound alarm.			1.6	1.3	6.9	.3	1.8	1.1
c. Secure electrical system if you have knowledge of the system.			3.3	2.1	6.8	.8	2.5	1.1
d. Obtain 15# CO <sub>2</sub> bottle and begin to fight fire.			2.2	1.5	6.4	.8	4.3	1.6
e. Rest of fire fighters suit out in Oxygen Breathing Apparatus (OBA) (weight 18#).			2.3	.9	6.3	1.1	4.1	.6
f. Bring overhaul gear to area (axe, rake, shovel or dust pan).			1.9	1.4	5.3	1.5	3.7	.9
g. Bring O <sub>2</sub> analyzer and red devil blower to area.			2.3	1.3	5.6	1.5	3.6	1.5
h. Bring two additional CO <sub>2</sub> bottles from repair locker to fire area (at least 100') and take up one deck.			2.1	1.1	5.8	1.3	4.7	.7
i. Rig hoses below deck -- 1 1/2" hose.			2.0	1.3	5.9	1.2	4.5	1.0
j. Rig hoses topside -- 2 1/2" hose.			2.0	1.1	5.6	1.5	4.8	.8
k. Bring portable lighting.			1.4	.6	5.6	1.3	3.3	1.2
l. Put fire out.			2.4	1.3	7.0	-	4.8	1.1
m. Clean up.			1.3	.4	5.0	1.8	3.7	1.7

TABLE C (Continued)  
Task List: Hull Technician

Task List	Frequency		Task Requirements		Task Importance		Effort	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
25. Fight Class Bravo Fire.	2.1	1.0	2.4	1.5	6.9	.3	5.6	1.4
a. Report fire.			1.4	.8	7.0	-	1.9	1.4
b. Sound alarm.			1.5	1.0	6.9	.3	2.0	1.5
c. Secure system.			3.0	2.0	6.9	.3	2.9	1.5
d. Obtain PKP extinguisher initially.			2.0	1.0	6.7	.5	3.7	1.0
e. Bring FP-180 pump to fire scene.			2.6	1.2	6.5	.6	5.2	.9
f. Carry twin agent (light water and PKP) nozzle and hose to area.			2.0	1.3	6.7	.6	5.1	1.3
26. Use of P-250 Pumps (147#).	2.6	1.0	3.1	1.4	6.2	.8	5.5	1.5
a. Take P-250 Pump down one deck to flooded area (2 people).			2.8	1.0	5.3	1.6	5.8	1.5
b. Carry hoses to flooded area (2 suction hoses, 1 exhaust hose, and 2 discharge hoses).			2.4	.8	5.8	1.2	5.0	1.5
c. Carry gas can (6 gallons, 40#) to flooded area.			1.8	.9	5.6	1.7	4.6	1.3
d. Prime and adjust throttle.			2.5	1.6	6.1	1.1	2.9	1.3
e. Start engine.			2.7	1.5	6.4	.8	3.9	1.3
f. Carry pump up to deck and replace in stowage.			2.4	1.0	4.9	1.7	5.5	1.3
g. Replace hoses and twin agent nozzle to stowage area.			1.9	1.0	4.9	1.5	4.7	1.6
27. Set up submersible pump for dewatering a flooded compartment.	2.4	1.1	2.8	1.0	6.6	.9	5.7	1.1
a. Carry pump and 100' of electric cord to flooded area.			2.6	1.0	6.7	.9	5.6	1.1
b. Bring control box for pump and 50' of electric cord to area.			2.1	1.1	6.4	1.4	4.9	1.2
c. Connect 2 lengths 2 1/2" hose.			2.0	1.0	6.3	1.6	4.6	1.2
d. Lower pump into flooded compartment.			2.4	1.1	6.3	1.5	5.4	1.2

TABLE C

Summary of Criticality Ratings on Each Scale by Major Tasks for Frequency  
and by Major and Sub-Tasks for Task Requirements, Task Importance and Effort

Task List: Gunner's Mate

Task List	Frequency		Task Requirements		Task Importance		Effort	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
1. PMS on breech block (175#) 3" - 50 gun.	2.3	.7	2.0	1.2	5.4	1.7	4.2	1.3
a. First GM crawls into appropriate area or places hand winching device in place.			2.1	1.2	3.1	1.6	2.2	1.2
b. Release pins and lower block onto chest with winch device.			2.3	1.4	5.7	1.6	4.1	1.7
c. Second GM reaches in and removes block from first GM.			2.6	1.5	4.8	2.0	4.9	1.5
d. Disassemble breech block, clean and repair.			2.0	1.2	5.8	1.6	2.6	1.6
e. Replace breech block by having second GM attach winch, lower block to first GM.			2.3	1.3	5.5	1.6	4.6	1.7
f. First GM cranks breech block, lifts block into place and sets the pins.			2.6	1.1	5.6	1.8	4.5	1.5
2. Release counter recoil spring on 3" - 50 gun.	1.8	.5	2.4	1.1	5.9	1.7	4.4	1.2
a. Put release plate on end of gun barrel.			1.8	.9	4.8	2.2	4.0	1.7
b. Attach cables, rods and bolts.			1.7	.8	5.6	1.8	3.2	1.2
c. Turn screws equally to appropriate pressure to relieve counter recoil spring tension.			1.9	1.0	6.0	1.6	3.6	1.5
3. Remove loader driver motor for PMS.	1.3	.5	2.9	1.5	4.1	2.5	4.6	1.2
a. Rig sling and unbolt motor (2 people).			2.5	1.6	3.7	2.1	3.8	1.3
b. Lift motor out of gun with chainfall.			2.0	1.1	4.9	2.3	3.5	1.5
c. Transport to work area.			2.5	1.3	3.3	1.9	4.2	1.5
d. Grease zinc fittings.			1.2	.4	3.4	2.5	1.4	.6
4. Check and make fine adjustments on 3" power drive.	2.2	.7	2.7	2.0	5.9	1.2	1.6	.7
5. Remove amplifier from train/elevation system.	1.8	.8	2.0	1.1	4.8	1.9	2.6	1.2
a. Pull out rack.			1.6	.7	4.0	1.9	2.2	1.1
b. Lift amplifier out of drawer.			1.8	1.0	4.4	2.2	3.0	1.2
c. Take to repair area.			1.8	1.0	3.9	2.3	3.1	1.2
6. Repair and adjust components of the control panels (e.g., circuit breakers, etc.).	2.0	.8	2.5	2.1	6.1	1.3	2.1	1.0
7. Load 5" mortar with rapid blooming off-board chaff.	2.3	.9	2.1	1.0	6.2	1.6	3.9	1.6
8. Load 3" - 50 gun during combat/gun shoot.	4.5	2.4	2.4	1.1	6.1	1.3	4.6	1.5
a. Second loader receives shell (40#) from magazine and places in rotary magazine.			2.1	.9	5.6	1.6	4.1	1.5
b. First loader lifts shell out of rotary magazine and places and pushes into loader (projectile chamber).			2.3	1.0	6.2	1.3	4.5	1.5
9. Load 5" - 54 gun Mark 42 with powder.	6.6	.9	2.4	1.1	6.1	1.2	4.6	1.0
a. Pull powder out of bins and canisters.			2.0	1.2	5.9	1.6	4.5	1.2
b. Pass powder to loader.			2.0	1.2	5.6	1.9	4.3	1.0
c. Load into rotary drum.			2.1	1.0	6.0	1.6	4.2	1.3
d. Push button to move rotary drum.			1.4	.8	4.7	2.3	1.4	.6
10. Load projectile on 5" - 54 gun Mark 42.	6.2	1.7	2.1	.9	6.4	1.3	5.3	1.4
a. Pull projectile out of bin or rack.			2.3	1.1	6.2	1.2	5.1	1.7
b. Pass projectile to loader.			2.1	.8	6.3	1.5	5.1	1.5
c. Place projectile in rotary drum.			2.4	.8	6.4	1.2	5.1	1.4
d. Press button to move rotary drum.			1.3	.8	4.8	2.5	1.5	1.1

TABLE C (Continued)  
Task List: Gunner's Mate

Task List	Frequency		Task Requirements		Task Importance		Effort	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
11. Carry boxes of small arms ammo to magazine (2 people).	2.8	1.9	1.9	1.1	4.7	1.9	4.9	1.3
a. Carry across deck.			2.0	1.2	4.5	2.1	4.6	1.3
b. Pass down two decks.			2.2	1.0	5.4	2.0	5.1	1.5
12. Rig two-fold and lower ammo to next deck.	2.4	.8	1.9	1.1	5.7	1.7	4.0	1.5
13. VEPTREP of stores with a cargo net and pallets (greater than 2,000 lbs.; 1 helo per 8 loads).	4.7	2.0	1.6	.9	5.6	1.7	4.1	1.3
<u>Delivery ship</u>								
a. Lay out cargo nets for receiving pallets from forklift.			1.2	.4	3.8	2.2	3.1	1.3
b. Attach becket and hoisting sling to the net and then to the safety hook.			1.5	.9	5.6	1.6	3.0	1.1
<u>Receiving ship</u>								
c. Release cargo hook from helo.			1.5	.8	5.4	1.7	2.8	1.3
d. After helo has departed, release pendant hook and open net.			1.4	.7	3.9	2.3	2.7	1.2
e. Cut landing on load.			1.5	.7	4.2	2.4	2.9	1.4
f. Pick up cargo, remove from drop zone, and place in the staging area.			1.7	.8	3.9	2.0	4.0	1.2
g. Pick up empty pallet and pendant, and place in staging area.			1.6	.7	3.5	2.2	4.1	1.1
h. Assemble 6 - 8 pallets, nets, and retrograde on drop zone for return to UNREP ship.			1.9	.9	4.1	2.0	4.2	1.3
14. Onload munitions for 5" - 54 guns (1,200 pieces).	3.8	2.0	1.9	.7	5.9	1.7	5.6	.8
a. Carry ammo across deck to ladder.			1.8	.7	5.7	1.9	5.5	1.1
b. Pass ammo by hand down two decks to the magazine.			2.1	.7	6.3	1.2	5.9	1.2
c. Use ammo hoist to lower ammo to magazine deck if available.			1.6	.7	5.5	2.0	3.6	1.6
d. Place powder in bins.			1.7	.8	6.0	1.6	4.9	1.2
e. Place projectiles in racks.			2.1	1.0	6.2	1.6	5.9	1.1
15. Unload/stage cargo on a receiving ship.	4.2	1.8	1.6	.7	3.7	1.2	4.5	1.1
a. Breakdown pallet after it has been moved to unloading area.			1.4	.5	3.3	1.6	3.8	1.5
b. Break bands and take off stores.			1.4	.6	3.8	1.7	3.6	1.6
c. Carry stores across the deck (e.g., frozen chicken, milk potatoes, etc.).			1.6	.5	2.9	1.2	4.5	1.2
d. Pass stores down several decks to storage area (e.g., frozen chicken, milk, potatoes, etc.).			1.8	.8	4.3	1.6	5.1	1.3
e. Place stores in bins (e.g., reefers).			1.7	.7	3.5	1.7	4.8	1.5
16. Secure hatch in a flooded compartment.	1.5	1.2	2.1	1.2	6.6	1.1	5.3	1.5
17. Open and close non-counter balanced scuttles in the overhead.	5.1	1.2	1.4	.5	4.8	2.1	3.3	1.3
a. Turn handle to open position.			1.3	.4	4.4	2.6	2.8	1.1
b. Push hatch straight up until it locks in open position.			1.5	.6	5.2	2.3	3.6	1.7
18. Take initial action on a Class Alpha fire.	2.5	1.8	1.5	.7	6.7	.7	2.1	1.2
a. Report fire.			1.3	.6	6.8	.5	1.8	1.3
b. Sound alarm.			1.2	.4	6.8	.6	1.4	.6
c. Obtain appropriate fire extinguisher and begin to fight fire.			1.4	.6	6.9	.2	3.4	1.0

TABLE C (Continued)  
Task List: Gunner's Mate

<u>Task List</u>	<u>Frequency</u>		<u>Task Requirements</u>		<u>Task Importance</u>		<u>Effort</u>	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
19. Control ruptured LP pipeline.	1.3	.7	2.3	1.7	5.2	1.6	3.5	1.3
a. Report problem.			1.5	.9	5.5	1.8	1.7	1.3
b. Secure system.			1.9	1.3	5.6	1.4	2.4	1.1
c. Put in soft patch by placing rag on wood stick and jamming into ruptured area.			1.9	1.5	5.3	2.1	3.4	1.5
d. Saw off wood and place 1/8" rubber sheet over area.			2.2	2.0	5.0	2.1	3.6	1.1
e. Wrap patch with marlin.			2.0	1.7	5.2	2.1	2.9	1.5
20. Patch a small hole in the bulkhead to retain incoming sea water.	1.7	1.7	2.6	1.9	6.6	1.0	4.3	1.4
a. Plug the hole with a piece of soft wood.			1.8	1.5	6.4	1.4	3.8	1.6
b. Work oakum or rags into the hole with a maul.			1.9	1.5	6.4	1.5	3.9	1.5
c. Wedge smaller pieces of wood into the hole.			1.6	1.0	6.3	1.5	3.6	1.6
d. Shore up the bulkhead around the hole.			2.6	1.9	6.3	1.7	5.1	1.4
e. For large holes, shore up the deck from the next lower deck.			2.7	1.8	6.8	.7	5.5	1.5



TABLE C

Summary of Criticality Ratings on Each Scale by Major Tasks for Frequency  
and by Major and Sub-Tasks for Task Requirements, Task Importance and Effort

Task List: Boatswains Mate

Task List	Frequency		Task Requirements		Task Importance		Effort	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
1. Prepare for STREAM probe refueling to a destroyer.	4.2	1.2	3.7	1.8	5.3	2.0	4.6	1.5
<u>Delivery ship</u>								
a. Breakout tool box.			1.7	1.3	4.4	2.1	3.6	1.6
b. Remove Robb and install probe on hose if applicable.			3.6	1.2	6.1	1.2	5.1	1.0
c. Fake out messenger, phone lines and hose messenger return line.			2.0	1.2	5.1	1.7	2.9	1.2
d. Tend hose messenger and phone lines.			2.6	1.7	5.2	1.9	3.6	1.4
e. Shoot messenger line over with shot line gun.			3.3	2.1	4.9	2.0	1.8	.7
f. After connection made to receiving ship, pull back messenger by hand (3 people).			1.7	1.0	4.1	1.9	3.9	1.4
<u>Receiving ship</u>								
g. Breakout tool box.			1.8	1.4	5.1	2.0	3.6	1.7
h. Rig fairlead block to padeye.			2.6	1.4	5.4	1.0	3.6	1.4
i. Reeve messenger through fairlead block and 15 people hand pull messenger and span wire over to receiving ship.			2.1	1.3	5.3	1.7	4.0	1.8
j. Connect span wire to padeye with pelican hook.			3.4	1.5	6.4	1.0	4.9	1.4
k. Cut stops.			2.8	1.1	5.8	1.3	3.1	1.2
l. Pull probe and hose over by hand.			1.7	1.1	5.4	1.6	5.4	1.3
m. Give hard pull for last several feet so that probe seats into probe receiver.			1.9	1.4	5.6	1.3	5.9	1.1
n. Rig easing out line.			2.9	1.2	5.1	1.6	3.1	1.0
o. Send messenger back to delivery ship.			2.3	1.6	4.1	1.9	2.9	.9
p. Tend easing out line after span wire is tripped.			2.3	1.5	4.9	1.2	3.4	1.3
2. Rig STAR latch to fixed padeye.	4.2	1.8	4.2	1.8	5.5	1.8	5.0	1.2
<u>Delivery ship</u>								
a. Bring SURF and STAR out of stowage and carry to station.			3.4	1.0	5.4	1.5	5.1	1.5
b. Reeve span wire through SURF and STAR, and trolley.			3.6	1.5	6.3	1.3	4.6	1.2
c. Fake out messenger.			2.8	1.4	4.9	1.8	2.8	1.0
d. Couple SURF and STAR on delivery ship.			3.8	1.4	6.1	1.1	4.2	1.1
e. Shoot messenger line over to receiving ship with shot line gun.			3.4	2.0	5.1	1.6	1.9	.8
<u>Receiving ship</u>								
f. Rig fairlead block to padeye.			2.6	1.5	5.6	1.7	3.6	1.3
g. Fifteen people pull messenger phone lines and span wire on board.			1.6	1.1	5.6	1.6	4.9	1.5
h. One person climbs up to fixed padeye and secures pelican hook to padeye long link.			3.9	1.3	6.1	1.1	4.8	1.4
i. Reach out and cut stops.			3.2	1.4	5.9	1.1	3.4	1.1
j. Install easing out line.			3.3	1.3	5.1	1.2	2.9	.7
k. Haul in STAR latch assembly.			2.9	1.6	5.5	1.3	4.9	1.1
l. Take messenger from split rings, coil and send it back.			2.9	1.7	4.4	1.7	3.5	.9
3. Receive provisions by cargo drop reel (CDR).	4.4	1.5	3.6	1.4	5.1	1.6	4.3	1.3
a. Delivery ship uses winch to transport CDR and palletized cargo to receiving ship.			3.8	1.6	6.1	1.3	3.2	1.4
b. CDR operator pulls on lanyard to release brake, after cargo arrives over deck of receiving ship.			2.8	1.7	5.1	1.4	3.4	.9

TABLE C (Continued)

Task List: Boatswains Mate

<u>Task List</u>	<u>Frequency</u>		<u>Task Requirements</u>		<u>Task Importance</u>		<u>Effort</u>	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
3. Receive provisions by cargo drop reel (CDR) (cont'd).								
c. When load nears deck cargo handlers (4 people) rotate load to place sling on forward and aft side.			2.3	1.1	4.9	1.4	3.7	1.0
d. Cargo handlers pull down on pallet to slack cable.			2.3	1.4	5.2	1.3	4.2	1.0
e. CDR operator pulls on lanyard to raise CDR hook.			2.4	1.6	4.8	1.4	3.8	1.2
f. Release slings and allow CDR to return for next load.			2.2	1.3	4.6	1.8	2.7	1.0
g. Move pallets out of staging area by means of hand jack.			2.1	1.0	4.2	1.4	3.9	.7
h. Stack empty pallets for return to delivery site.			1.9	.8	3.9	1.5	4.1	1.0
i. After four loads, move four pallets to staging area, slip slings of bars into bottom of pallet, and attach sling hooks.			2.3	1.0	4.0	1.6	4.1	1.1
j. Four cargo handlers assist in lifting pallets up until they clear the safety line.			2.3	1.2	4.3	1.5	4.7	1.1
4. Unrig STAR latch assembly.	3.8	1.7	3.0	1.9	5.5	1.7	4.9	1.0
a. Pull lanyard to trip STAR latch assembly.			2.7	1.7	5.8	1.1	4.0	1.2
b. Trip pelican hook.			2.5	1.5	6.3	.9	4.1	1.3
c. Slack span wire easing out line by hand.			2.5	1.3	5.9	1.2	4.3	1.4
PAINT RELATED TASKS (Numbers 5 - 12)								
5. Take 5 gallon cans of paint (45 - 50W) down to stowage area below the water line.	3.5	1.2	1.9	.7	3.8	1.9	4.9	1.4
6. Place 5 gallon paint can into bins.	3.3	1.1	2.1	.8	4.0	2.1	4.8	1.3
7. Complete a paint breakout (two hours in morning; two hours in afternoon).	4.3	.8	2.8	1.1	3.6	1.2	5.0	1.3
8. Chip paint with pneumatic tool (e.g., deck crawler, knuckle buster, needle gun).	4.6	1.8	1.8	.6	3.5	1.4	4.7	1.1
9. After chipping paint, use wire brush to remove remaining paint.	4.4	1.7	1.8	.6	4.4	1.9	4.3	1.0
Rig boatswain chair and hoist seaman aloft.	3.2	1.1	3.9	1.5	5.0	1.7	4.3	1.3
Rig stage (2 people) for painting ship sides.	2.8	1.2	3.4	1.3	4.8	2.0	4.4	1.4
a. Control own weight to lower stage to proper position.			4.0	1.4	4.7	2.1	4.8	1.1
b. Tend safety lines and replenish paint supply.			3.1	1.8	4.8	2.1	3.9	1.2
c. Pull stage and occupants back up to deck.			3.5	1.3	5.0	1.7	5.1	1.4
12. Paint ship sides with rollers for five hours from a stage.	2.1	.9	3.2	1.6	3.8	1.6	4.2	1.3
13. Install l-clamp and rig chainfall for removing main recirculating pump.	1.3	.7	4.5	1.6	4.9	1.5	4.5	1.4
14. Rig chainfall to fixed padeye for removing compressor from a walk-in refrigerator.	1.6	1.1	4.0	1.9	4.8	1.6	4.6	1.4
a. Carry chainfall and come-along to area.			2.1	1.1	3.9	2.0	4.9	1.3
b. Rig chainfall to compressor.			3.6	2.0	5.2	1.7	3.8	1.3
c. Lift compressor with chainfall.			3.7	2.2	5.4	1.4	4.4	1.3
d. Remove interference.			4.2	1.8	5.2	1.6	4.3	1.3
e. Remove compressor via chainfall and come-along to another area.			4.1	1.9	5.5	1.6	5.3	1.3

TABLE C (Continued)  
Task List: Boatswains Mate

Task List	Frequency		Task Requirements		Task Importance		Effort	
	X	S.D.	X	S.D.	X	S.D.	X	S.D.
15. Moor ship to pier.	3.7	.6	3.2	1.6	5.5	1.6	4.8	1.2
a. Breakout mooring line off of a reel or out of boatswain's locker.			1.8	1.0	4.6	2.0	4.6	1.0
b. Take out 600' of 8" circumference line.			2.4	1.2	4.4	1.7	4.8	1.0
c. Throw heaving line to pier.			2.8	.9	4.8	1.9	3.5	1.0
d. Pull/slack mooring line from ship to pier by hand (2 people).			2.5	1.4	4.4	1.7	4.9	1.4
e. Place mooring line over bollard on pier.			1.8	.7	5.1	1.9	3.9	1.5
f. Place mooring line on bow and stern around capstan and tend line (if no capstan, use two-fold).			3.3	1.0	5.2	1.4	4.5	1.4
g. Pull in spring line with two-fold (7 - 10 people).			3.2	1.4	4.9	1.4	4.9	1.4
h. Pass rat tail stopper.			4.1	1.7	5.3	1.5	3.7	1.1
i. Figure 8 mooring line on bitt and saddle up line over Figure 8.			2.6	1.5	4.8	1.6	3.8	1.1
j. Frap all mooring lines.			4.4	1.5	3.2	1.9	4.4	1.3
k. Attach rat guard to mooring lines.			3.4	1.5	3.8	2.0	3.7	1.1
16. Getting underway.	3.5	.6	3.1	1.3	5.2	1.8	4.6	1.5
a. Unfrap lines and remove rat guard.			3.0	1.2	5.2	2.0	3.8	1.4
b. Unsaddle mooring lines and fake out excess.			2.4	1.3	4.5	1.9	3.8	1.1
c. Slack off.			2.4	1.4	5.2	1.7	3.5	.9
d. Remove mooring lines by flipping off of the bollard (2 people).			2.1	1.1	4.9	1.9	3.5	1.1
e. Haul mooring line back aboard ship with 6 people.			1.9	1.3	4.7	1.9	4.5	1.4
f. Put mooring line back in storage.			2.1	1.3	4.2	1.8	4.5	1.2
17. Moor ship to bouy.	2.1	.7	4.7	1.9	6.1	1.2	5.1	1.8
a. Unreel and force out 600' of wire/springlay on forecastle.			3.5	1.7	4.6	1.9	5.2	1.3
b. Secure anchor and leave one stopper attached.			3.9	1.8	6.2	1.3	4.9	1.3
c. Secure chain leading to chain locker to keep it from running down chain pipe.			4.6	1.7	6.2	1.2	4.6	1.2
d. Reeve 21 thread at six foot intervals to walk chain out to bulinose.			3.9	1.8	4.8	1.4	3.9	1.3
e. Attach mooring shackle.			4.3	1.7	6.1	1.3	4.9	1.5
f. Attach two or three oversized shackles with short wire straps to wire/springlay and anchor chain for use as a trolley method.			4.7	1.4	5.8	1.3	4.6	1.5
g. Use power of wildcat to walk anchor out through bullnose to water line.			4.7	1.9	6.2	1.1	3.9	1.5
h. Buoy party attaches wire/springlay to ring on buoy.			4.9	1.6	6.4	.9	5.6	1.5
i. Buoy party shackles mooring shackle to buoy ring.			4.9	1.6	6.4	.9	5.5	1.5
18. Rig SAV-ALL safety net under brow.	3.2	.9	2.5	1.3	4.3	2.2	3.8	1.1
a. Breakout cargo nets from storage.			1.9	1.1	3.5	2.0	3.3	1.1
b. Unrig and stow cargo nets.			2.0	.9	3.5	1.9	3.1	1.2
19. Bolt (marry) causeways together.	1.6	1.1	5.4	1.8	6.4	.9	5.6	1.4
20. Tear down refueling rig for hose pressure testing.	1.8	.9	3.7	2.0	5.8	1.1	5.3	1.3
a. Detach hoses from trolley and lay out on deck.			3.5	1.8	4.9	1.1	5.1	1.4
b. Take off saddle wire.			3.3	1.7	5.4	1.1	4.6	1.2
c. Uncouple hoses.			3.3	1.5	4.9	1.8	4.4	1.2
d. Carry each piece of hose to pier for testing.			2.3	1.1	4.9	1.7	5.1	1.4
e. Perform tasks in inverse order to rerig fueling station.			3.9	1.7	6.1	1.1	5.4	1.3

TABLE C (Continued)  
Task List: Boatswains Mate

Task List	Frequency		Task Requirements		Task Importance		Effort	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
21. Semi-annual PMS on wires in winches.	1.7	.5	3.6	1.5	6.1	1.2	4.6	1.2
a. Unreeve wires off of winches.			3.6	1.5	5.9	1.1	4.9	1.1
b. Wirebrush old grease off of wires, inspect and regrease wires.			2.7	1.5	5.5	1.4	4.2	1.1
c. Spool wires back onto winch spool.			3.8	1.7	6.0	1.1	4.5	1.1
22. Once every 18-months perform PMS on anchor chain.	1.0	.0	4.6	1.8	5.6	1.8	5.5	1.7
a. Take out anchor chain on a barge.			4.4	1.7	5.4	1.6	5.6	1.4
b. Clean, inspect, preserve, paint and end-for-end (if needed) anchor chain.			4.6	1.7	5.6	1.2	5.3	1.3
c. Replace anchor chain to appropriate position.			4.5	1.8	5.9	1.4	5.5	1.5
d. Pass stoppers.			3.8	1.6	6.0	1.3	5.1	1.4
23. Remove bushings and bearings from fairlead block (aloft).	1.3	.5	4.2	1.8	5.4	1.4	4.9	1.4
a. Rig boatswain's chair.			3.6	1.7	5.4	1.5	4.1	1.4
b. Hoist man aloft to remove block.			3.8	1.6	6.0	1.0	4.6	1.4
c. Overhaul block.			4.1	1.7	5.8	1.3	4.4	1.3
d. Replace block.			3.8	1.6	6.0	1.2	4.6	1.3
24. Move floor buffers from deck to deck.	5.2	.9	1.9	1.0	2.7	2.0	3.7	1.4
25. Serve as first loader on 3" - 50 gun.	2.3	.8	3.8	1.8	5.1	1.8	4.7	1.2
26. Serve as powder loader on 5" - 54.	2.5	.8	3.6	1.9	5.1	2.0	4.9	1.1
27. Serve as projectile loader on 5" - 54.	2.4	.7	3.9	1.8	5.1	2.0	5.0	1.2
28. Breakout ammo from magazine and take to ready service locker.	2.1	.4	3.1	1.9	5.4	1.5	4.9	1.1
29. Breakout daily stores (e.g., milk, ice cream, etc.) and take to mess area (minimum up one deck).	4.7	1.0	2.5	1.5	4.6	1.9	4.0	1.0
30. Shore up cargo--deck loading.	3.0	1.0	4.3	1.8	5.9	1.5	4.5	1.4
a. Place dunnage and chocks between cargo.			3.9	1.8	5.3	1.5	4.6	1.0
b. Lash cargo down (use a peck and hale gripe).			3.6	1.9	5.8	1.4	4.6	.9
31. VERTREP of stores with a cargo net and pallets (greater than 2,000 lbs.; 1 helo per 8 loads).	3.5	1.4	4.2	1.9	5.6	1.5	4.6	1.3
<u>Delivery ship</u>								
a. Lay out cargo nets for receiving pallets from forklift.			2.6	1.6	4.8	1.6	3.5	1.1
b. Attach becket and hoisting sling to the net and then to the safety hook.			2.8	1.7	5.5	1.7	3.6	1.1
<u>Receiving ship</u>								
c. Release cargo hook from helo.			2.8	1.5	5.5	2.1	3.0	1.2
d. After helo has departed, release pendant hook and open net.			2.5	1.4	4.3	2.0	3.2	1.0
e. Cut banding on load.			2.3	1.2	4.0	2.3	3.2	1.6
f. Pick up cargo, remove from drop zone, and place in the staging area.			2.3	1.2	4.3	2.2	4.4	1.3
g. Pick up empty pallet and pendant, and place in staging area.			2.3	1.2	4.1	2.1	4.0	1.3
h. Assemble 6 - 8 pallets, nets, and retrograde on drop zone for return to UNREP ship.			2.8	1.5	4.2	1.9	4.2	1.2

TABLE C (Continued)

Task List: Boatswains Mate

Task List	Frequency		Task Requirements		Task Importance		Effort	
	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>	<u>X</u>	<u>S.D.</u>
32. Unload munitions for 5" - 54 guns (1,200 pieces).	2.1	1.2	2.8	1.4	5.4	1.8	5.2	1.4
a. Carry ammo across deck.			1.9	1.0	5.0	2.1	5.1	1.0
b. Pass ammo by hand down two decks and to the magazine.			2.0	1.0	5.3	2.1	5.3	1.1
c. Use ammo hoist to lower ammo to magazine deck if available.			3.0	1.8	6.4	1.6	4.0	1.5
d. Place powder in bins.			2.7	1.6	5.7	1.5	4.8	1.3
e. Place projectiles in racks.			2.6	1.3	5.9	1.0	5.0	1.2
33. Unload/stage cargo on a receiving ship.	2.8	1.4	2.7	1.4	4.7	1.8	4.6	1.3
a. Breakdown pallet after it has been moved to unloading area.			2.2	1.2	4.4	1.9	4.3	.9
b. Break bands and take-off stores.			1.8	.8	4.5	1.8	4.1	1.1
c. Carry to stores (e.g., frozen chicken, milk, potatoes, etc.) across the deck.			1.7	.6	4.3	1.9	4.6	.7
d. Pass stores down several decks to storage area (e.g., reefer deck).			1.8	.8	4.6	1.6	4.8	1.0
e. Place stores in bins (e.g., reefers).			2.4	1.3	4.6	1.7	4.8	.9
34. Secure hatch in a flooded compartment.	1.6	1.1	3.3	1.8	6.4	1.0	5.2	1.6
35. Open and close non-counter balanced scuttle hatches in the overhead.	3.7	1.5	2.6	1.3	4.7	1.7	3.9	1.1
a. Turn handle to open position.			2.2	1.5	5.3	1.6	3.6	1.1
b. Push hatch straight up until it locks in open position.			2.2	1.2	5.5	1.5	4.1	1.0
36. Take initial action on a Class Alpha fire.	2.3	1.2	2.4	1.6	6.4	1.2	2.8	1.6
a. Report fire.			2.1	1.5	6.4	1.4	2.5	1.4
b. Sound alarm.			2.2	1.4	6.4	1.4	2.5	1.2
c. Obtain appropriate fire extinguisher and begin to fight fire.			2.6	1.5	6.1	1.4	3.8	1.4
37. Control ruptured LP pipeline.	2.0	1.2	4.2	2.1	6.1	1.2	4.3	1.4
a. Report problem.			2.5	1.8	5.9	1.5	2.5	1.1
b. Secure system.			4.1	2.2	6.2	1.4	3.1	1.3
c. Put in soft patch by placing rag on wood stick and jamming into ruptured area.			4.6	1.7	5.9	1.3	3.8	1.1
d. Saw off wood and place 1/8" rubber sheet over area.			4.4	2.0	5.8	1.2	4.1	1.2
e. Wrap patch with marlin.			3.8	2.0	5.6	1.3	3.8	1.2
38. Patch a small hole in the bulkhead to retain incoming sea water.	1.4	.9	4.4	1.7	6.4	1.0	4.4	1.2
a. Plug the hole with a piece of soft wood.			3.9	1.9	6.3	1.2	3.9	1.4
b. Work oakum or rags into the hole with a maul.			3.9	1.9	6.0	1.2	4.1	1.2
c. Wedge smaller pieces of wood into the hole.			3.6	1.9	5.7	1.5	3.9	1.1
d. Shore up the bulkhead around the hole.			4.9	2.0	5.7	1.6	4.9	1.5
e. For large holes, shore up the decks from the next lower deck.			5.0	1.9	6.1	1.2	5.2	1.5

APPENDIX D

FINAL TASK LIST  
Z-SCORE TRANSFORMATIONS

TABLE D-1

## Final Task List as Determined by Scale Source and Weighting

Task List: Machinists Mate

Task Statement	Scale Z-Score Value*			
	Frequency	Task Requirements	Task Importance**	Effort Evaluation
• Replace defective relief valve in the overhead.				
1. Unbolt valve from flanges using appropriate tools.		-.86		Medium
2. Use slugging wrench if necessary.		.96		High
3. Lower valve to deck, using come-along or chainfall.		2.40		Low
• Remove auxiliary circulating pump from underneath evaporator.				
4. Crawl under evaporator with hand tools.			-.82	Medium
5. Make necessary repairs, replace bearing and wearing rings, and perform PMS.			-.03	Medium
6. Roll/rotate pump by hand.				-.69 Low
• GENERAL TASKS.				
7. Remove main drain valve from bilges (150#).	-.96			High
8. Replace main drain valve into bilge.				1.56 High
9. Replace 48" flywheel on HP air compressor.	.04			High
a. Bring down one deck with come-along and chainfall to engine room.				
b. Roll through passage way and around other equipment as necessary.				
c. Remove all interference to have clear passage from ladder to compressor.				
d. Rig and rerig come-along and chainfalls at one end of compressor in order to raise flywheel and pass it to other end of compressor. Use existing padeyes and I-clamps.				
e. Lower flywheel into place.				
10. Install new gaskets and "O" rings on HP air compressor.				-1.93 Low
11. Perform PMS on air ejector.	1.20			Low
a. Remove interference.				
b. Remove block cover.				
c. Remove air ejector steam nozzle.				
d. Clean/replace nozzle as necessary.				
e. Install nozzle, block cover and interference.				
12. Receive auxiliary circulating pump in shop (or on tender).		-1.93		Low
13. Rig and remove upper half of spring bearing on main shaft.			1.85	Medium
14. Remove interference as necessary (e.g., deck plates, etc.) to replace line shaft bearing.		.05		High
15. Remove convection heaters and pressure test.				.05 Medium
a. Remove heater and deliver to repair facility.				
b. Pick up heater when complete and reinstall.				
16. Carry tool bag (35#) to work area.	2.10			Low
17. Carry 5 gallon cans of freon to large air conditioning unit (2 people, 150#).	-1.94			High
18. Obtain appropriate fire extinguisher and/or hose and begin to fight a Class Alpha fire.		Selected for Generic Tasks	.57	Medium
19. Open and close non-counter balanced scuttles in the overload.		Selected for Generic Tasks	.48	Medium
20. Pass munitions for 5" - 54 guns by hand down two decks to the magazine.			.96	High
21. During VERTREP, assemble 6 - 8 pallets, nets, and retrograde on drop zone for return to UNREP ship.		Selected for Generic Tasks	.70	Medium
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefers).		Selected for Generic Tasks	.48	Medium
23. Load projectiles for a 5" - 54 gun.			.96	High

\*When Z-scores were not large enough (-2 or +2) to meet the decision model, tasks nearest the decision point was chosen.

\*\*There were no tasks close to a standard score of -2; therefore, another generic task was selected.

TABLE D-1

## Final Task List as Determined by Scale Source and Weighting

Task List: Hull Technician

Task Statement	Scale Z-Score Value*				Effort Evaluation
	Frequency	Task Requirements	Task Importance	Effort	
1. Remove and replace an overhead valve for 4" diameter LP pipe (pry pipe apart to lift valve out).		1.02			Medium
2. Clamp 3' length of 5" pipe in pipe bender and bend to desired degree.		-.96			Low
3. Braze new 3" flange onto old pipe.				-1.90	Low
4. Use plate shear to cut 5/8" plate 4' x 7'. a. Obtain plate from stowage using overhead crane to carry to plate shear. b. Position plate on rollers. c. Push through machine. d. Cut.			-2.10		High
5. Carry Argon gas bottle to welding area (2 people).	.10				High
6. Fabricate new duct using old duct as a pattern.			-1.90		Medium
7. Bring electric welding lead from stowage to patch a 1' x 2' hole in hull.		-2.00			Low
8. Patch a hole in the outer skin of a submarine. This includes: a. Prepare bevel. b. Weld dogs to hold patch. c. Insert patch. d. Tack weld patch. e. Grind tacks. f. Run root pass. g. Continue welding in accordance with approved sequence. h. Grind all starts and stops.				1.04	Medium
9. Clean drains. a. Use plunger. b. Use hand snake 25'. c. Use electric snake.	.87				Medium
10. Arc weld a 3' section of low pressure 3" pipe into position in place of the removed damaged piece.		Additional Relevant HT Tasks		.31	Medium
11. Rig torch, oxygen and acetylene to weld.				-.94	Low
12. Fight Class Charlie fire.	2.10				High
13. Bring overhaul gear to area (oxygen, rake, shovel, etc.) when fighting a Class Charlie fire.		Additional Relevant HT Tasks		.35	Medium
14. Rig hoses below deck - 1 1/2" hose to fight a Class Charlie fire.				1.40	High
15. Take P-250 Pump (147#) down one deck to flooded area (2 people).			.96		High
16. Start engine on P-250 Pump.		1.03			Medium
17. Control ruptured LP pipeline.	-1.80				Low
18. Obtain appropriate fire extinguisher and/or hose and begin to fight Class Alpha fire.		.03			Medium
19. Open and close non-counter balanced scuttles in the overhead.	-.71				Medium
20. Pass boxes of small arms ammo down two decks.			1.42		High
21. During VERTREP, assemble 6 - 8 pallets, nets, and retrograde on drop zone for return to UNREP ship.				.02	Medium
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefers).			.05		Medium
23. Load projector for a 5" - 54 gun.		Selected for Generic Tasks		.66	Medium

\*When Z-scores were not large enough (-2 or +2) to meet the decision model, tasks nearest the decision point was chosen.



TABLE D-1

## Final Task List as Determined by Scale Source and Weighting

Task List: Boatswains Mate

Task Statement	Scale Z-Score Value*				Effort Evaluation
	Frequency	Task Requirements	Task Importance	Effort	
● <u>Stream probe refueling to a destroyer.</u>					
1. Breakout tool box.		-1.50			Low
2. Fifteen people pull messenger phone lines and span wire on board.	.83				Medium
3. Connect span wire to fixed padeye with pelican hook.			1.60		Medium
4. Give hard pull for last several feet so that probe seats into probe receiver.				2.05	High
5. Rig easing out line.			-.06		Low
● <u>Getting underway.</u>					
6. Remove mooring lines by flipping off of the bollard (2 people).				-1.01	Low
7. Haul mooring line back aboard ship with 6 people.	-.91				High
● <u>GENERAL TASKS</u>					
8. During an UNREP release slings from cargo drop reel to allow for its return to the delivery ship.				-2.05	Low
9. One person load 15 5-gallon cans of paint into storage bins.	.15				Medium
10. Rig boatswain chair and hoist seaman aloft.				.04	Medium
11. Chip paint with pneumatic tool (e.g., deck crawler, knuckle buster, needle gun) for two hours.			-2.17		Medium
12. Rig chainfall to fixed padeye for removing compressor from a walk-in refrigerator.		.98			Medium
13. Pull/slack mooring line from ship to pier by hand (2 people).			-1.02		High
14. Rig SAV-ALL safety net under brow.	1.10				Low
15. Bolt (marry) causeways together.		2.50			High
16. After performing PMS on anchor chain, replace chain to appropriate position in chain locker.			.97		High
17. Serve as first loader on 3" - 50 gun.	-1.65				High
18. Obtain appropriate fire extinguisher and/or hose and begin to fight a Class Alpha fire.		Selected for Generic Tasks		-.63	Low
19. Open and close non-counter balanced scuttles in the overhead.		-.99			Low
20. Breakout ammo from magazine and take up two decks to ready service locker.		.02			High
21. During VERTREP, assemble 6 - 8 pallets, nets, and retrograde on drop zone for return to UNREP ship.		Selected for Generic Tasks		-.07	Low
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefers).		Selected for Generic Tasks		.63	Medium
23. Serve as projectile loader on 5" - 54 gun.				.95	High

\*When Z-scores were not large enough (-2 or +2) to meet the decision model, tasks nearest the decision point was chosen.

TABLE D-1

## Final Task List as Determined by Scale Source and Weighting

Task List: Gunner's Mate

Task Statement	Scale Z-Score Value*				Effort Evaluation
	Frequency	Task Requirements	Task Importance	Effort	
• PMS on breech block (175#) 3" - 50 gun.					
1. Crawl into appropriate area to perform PMS.			-2.09		Low
2. Second GM reaches in and removes block from first GM.				.95	Medium
3. Replace breech block on 3" - 50 gun by having one GM attach winch, lower block to other GM.		.94			Medium
• During VERTREP.					
4. Lay out cargo nets for receiving pallets from forklift.		-1.70			Medium
5. Cut banding from pallets.		-.92			Low
• GENERAL TASKS.					
6. Remove loader driver motor for PMS.	-1.12				Medium
a. Rig sling and unbolt motor (2 people).					
b. Lift motor out of gun with chainfall.					
c. Transport to work area.					
d. Grease zirc fittings.					
7. Release counter recoil spring on 3" - 50 gun.				.55	Medium
a. Put release plate on end of gun barrel.					
b. Attach cables, rods, and bolts.					
c. Turn screws equally to appropriate pressure to relieve counter recoil spring tension.					
8. Check and make fine adjustments on 3" power drive.		1.95			Low
9. Load 5" mortar with rapid blooming off-board chaff.		Additional Relevant GM Tasks		.06	Medium
10. Load 3" - 50 gun during combat/gun shoot.	.91				High
11. Use ammo hoist to lower munitions for 5" - 54 gun to magazine deck.				.04	Low
12. Carry munitions for 5" - 54 gun from staging area across deck to ladder.				1.50	High
13. Place projectiles for 5" - 54 gun in racks.			.90		High
14. Plug a small hole in the bulkhead with a piece of soft wood.				-.02	Medium
15. Repair and adjust components of the control panels (e.g., circuit breakers, etc.).		Additional Relevant GM Tasks		-1.52	Low
16. To patch large hole in bulkhead, shore up the deck from the next lower deck.				1.51	High
17. Control ruptured LP pipeline.	-1.07				Low
18. Obtain appropriate fire extinguisher and begin to fight Class Alpha fire.			1.63		Low
19. Open and close non-counter balanced scuttles in the overhead.			-.85		Medium
20. Pass boxes of small arms ammo down two decks (2 people).	-.14				Medium
21. During VERTREP, assemble 6 - 8 pallets, nets, and retrograde on drop zone for return to UNREP ship.		.03			Medium
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefer).		Selected for Generic Tasks		.65	Medium
23. Load projectiles for a 5" - 54 gun Mark 42.	1.97				High

\*When Z-scores were not large enough (-2 or +2) to meet the decision model, tasks nearest the decision point was chosen.

APPENDIX E

PAA MANUAL: SCALES  
AND INSTRUCTIONS

## PHYSICAL ABILITIES ANALYSIS

### INTRODUCTION

Physical Abilities Analysis is a method to evaluate the physical demands of jobs. Every job is made up of a group of tasks that must be completed effectively for the worker to exhibit successful job performance. Different jobs are made up of different tasks and require different abilities for effective performance. The abilities that we will consider are the physical traits of the worker that produce successful performance of the different tasks that make up the job.

Physical Ability Analysis describes the physical abilities needed to do the physical part of a job. This manual contains eleven rating scales that pertain to one's physical abilities. These eleven physical abilities include Upper and Lower Body Static, Dynamic, Explosive, and Trunk Strength, Flexibility, Equilibrium, Stamina, and Effort.

Each scale consists of seven points. The number "7" at the top of the scale is the greatest amount of physical ability any task could have. The number "1" at the bottom is the lowest amount of physical ability any task could have. Number "4" on the scale is an average or moderate amount. You will use the eleven physical ability scales to rate a series of tasks that make up your job.

Before continuing, please complete the consent form found on the next page.

## INSTRUCTIONS

To use the Physical Abilities Analysis Manual you must be familiar with the definition of each ability. These abilities are defined and examples are given to tell you what the ability is and how it differs from other similar abilities. For example, to familiarize yourself we will read the definition and comparison information for the first ability, Upper Body Static Strength.

Now read the first task on the list, and then think about the definition of Upper Body Static Strength. Next, decide how much Upper Body Static Strength is needed. Use the 7-point scale located below the definition and comparisons and choose the number you think is the amount of the ability needed to do the task.

The numbers 1 to 7 represent the amount of Upper Body Static Strength that is required to perform the task. The number "7" at the top of the scale indicates the greatest amount of Upper Body Static Strength that any job could require. The number "1" at the bottom represents the lowest amount of Upper Body Static Strength any task could require. Number "4" is an average amount of Upper Body Static Strength. Examples of tasks that need different amounts of the ability are on the right-hand side of the scale. These examples are there to help you decide how much of the ability is needed to do the task you are describing. For example, "Reach over and behind a table to lift a 70 lb. box onto a table," is a task that requires a great deal of Upper Body Static Strength. If the task you are describing usually requires even more Upper Body Static Strength than this, it would be somewhere nearer to the "7" at the top of the scale. "Lift one package of bonded paper," requires very little Upper Body Static Strength. If the task you are describing requires even less Upper Body Static Strength than this, it would be somewhere nearer to the "1" at the bottom of the scale. "Carry a 5 gallon bucket of water," requires more Upper Body Static Strength than "Lifting a package of bond paper," and much less than "Reach over and behind a table to lift a 70 lb. box onto a table."

How do you decide how much of each physical ability (e.g., Upper

Body Static Strength) is needed to do the task in your job? Consider these steps:

First, think about what the worker does in the task you are describing that needs this ability.

Second, use the examples to the right of the scale by asking the questions, "Does the worker need more, just about the same, or less of the ability than this example?"

Some words of caution:

- (1) Assume the worker is trained and experienced.
- (2) Do not overrate the amount of the ability (e.g., Upper Body Static Strength, Flexibility, etc.) required to do the job. It is often the case that people involved with a job assume it is more demanding than it really is.
- (3) If the worker performs a task requiring a great deal of an ability (e.g., Upper Body Static Strength) whether frequently or infrequently, it should be rated high.

Choose a number on the scale from 7 to 1 that you think is the amount of the ability needed to do the job and place it in the space provided to the left of the task statement. If you are unfamiliar with a task, place a "9" in the space provided to the left of the task statement. Please continue through all the tasks in the same manner by placing your rating in the space provided.

When you have rated all of the tasks for Upper and Lower Body Static Strength, stop and wait for further instructions. We will then proceed as a group in the same fashion through the remaining nine scales.

If you have any questions, please ask the administrator. If not, you may begin.

## UPPER BODY STATIC STRENGTH

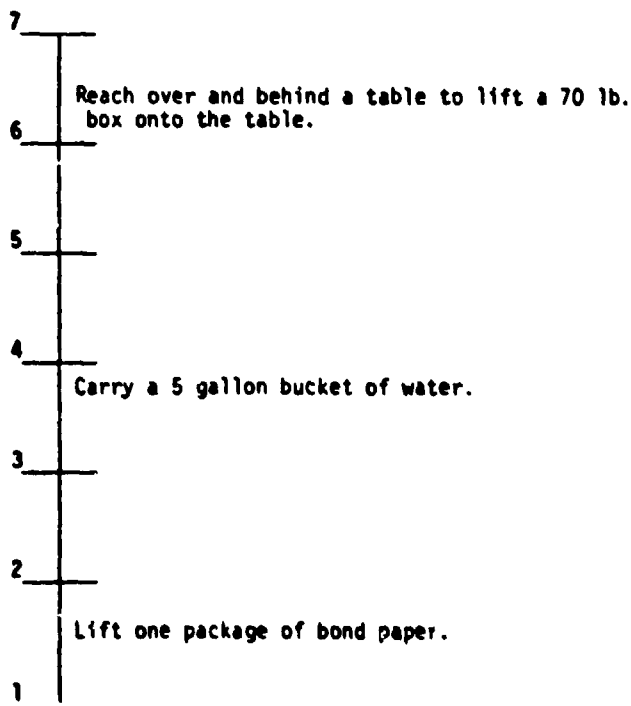
This is the ability to use muscle force in the upper part of the body (i.e., above the waist) in order to lift, push, pull, or carry objects. It is the maximum force that one can exert for a brief period of time. This ability involves the muscles of the hands, arms, upper back, and shoulders.

### HOW UPPER BODY STATIC STRENGTH IS DIFFERENT FROM OTHER ABILITIES:

Use the muscle of the upper body to exert force against <u>objects</u> .	vs.	<u>Trunk Strength</u> : Use upper body muscle force <u>repeatedly</u> to hold up or move part, not all, of one's body, using stomach and <u>lower</u> back muscles.
Use of continuous upper body muscle strength with little or no change in body or arm position to lift, push, pull, or carry an object.	vs.	<u>Explosive Strength</u> : Gather energy to move one's own body and to propel some object with short bursts of muscle force that involve rapid movement of one or more of the upper body parts.
Does <u>not</u> involve the use of upper body muscle force over a long time.	vs.	<u>Dynamic Strength</u> : Use of repeated upper body muscle force over <u>long time periods</u> to hold up one's body or an object.

## UPPER BODY STATIC STRENGTH

Requires use of maximum muscle force above the waist necessary to lift, push or pull very heavy objects.



Requires use of little muscle force above the waist necessary to lift, push or pull light objects.

## LOWER BODY STATIC STRENGTH

This is the ability to use muscle force in the lower part of the body (i.e., below the waist) in order to lift, push, pull, or carry objects. It is the maximum force that one can exert for a brief period of time. This ability involves the muscles of the feet and legs.

### HOW LOWER BODY STATIC STRENGTH IS DIFFERENT FROM OTHER ABILITIES:

Use the muscles of the lower body to exert force against objects.

vs.

Trunk Strength: Use lower body muscle force repeatedly to hold up or move part, not all, of one's body, using stomach and lower back muscles.

Use of continuous lower body muscle strength with little or no change in body or leg position to lift, push, pull, or carry an object.

vs.

Explosive Strength: Gather energy to move one's own body and to propel some object with short bursts of muscle force that involve rapid movement of one or more of the lower body parts.

Does not involve the use of lower body muscle force over a long time.

vs.

Dynamic Strength: Use of repeated lower body muscle force over long time periods to hold up one's body or an object.

## LOWER BODY STATIC STRENGTH

Requires use of maximum muscle force below the waist necessary to lift, carry, push or pull a very heavy object.



Stand up from a crouching position holding a 70 lb. package.

Walk a few steps on flat terrain carrying a 50 lb. back pack.

Apply and hold bicycle foot brakes to stop completely.

Requires use of a little muscle force below the waist necessary to lift, carry, push or pull a light object.



## UPPER BODY DYNAMIC STRENGTH

This is the ability of the muscles of the upper part of the body (i.e., above the waist) to exert force repeatedly or continuously over a long time period. This is the ability to support, hold up, or move the body's own weight and/or objects repeatedly over time. It represents muscular endurance and emphasizes the resistance of the muscles in the hands, arms, upper back, and shoulders to fatigue.

### HOW DYNAMIC STRENGTH IS DIFFERENT FROM OTHER ABILITIES:

Hold up or move one's body weight or objects repeatedly by continuously changing the position of the upper body parts to accomplish the task.	vs.	<u>Static Strength</u> : Exert a muscular force with the upper body parts for a brief time period. These body parts show little or no movement.
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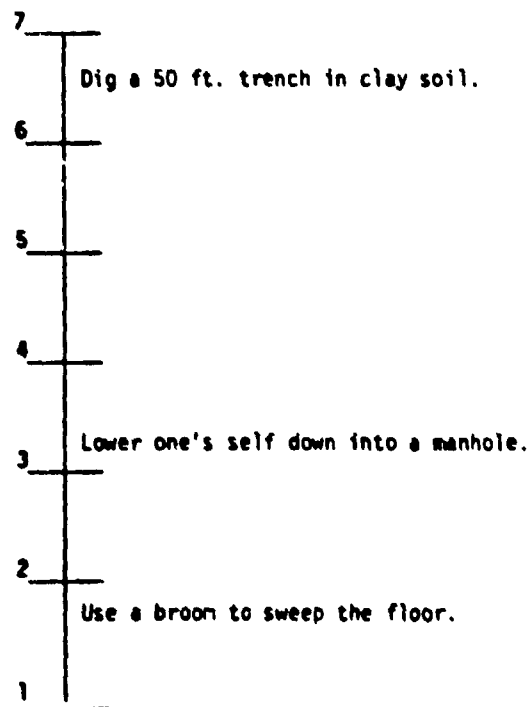
Use one's upper body muscles to continuously (e.g., more than 10 seconds) hold up an object or support one's body weight.	vs.	<u>Explosive Strength</u> : Use of short bursts of muscle force that involve rapid movement of one or more of the upper body parts.
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Hold up one's entire body weight with the <u>hands</u> , <u>arms</u> , and <u>shoulders</u> .	vs.	<u>Trunk Strength</u> : Hold up or move <u>part</u> , not all, of one's body, using mainly <u>stomach</u> and <u>lower back</u> muscles.
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Involves the ability of the muscles of the upper body to repeatedly exert force over a long time period.	vs.	<u>Stamina</u> : The ability to perform a physical task without getting out of breath.
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## UPPER BODY DYNAMIC STRENGTH

Requires use of maximum muscle force above the waist necessary to hold up or move the body weight or objects for long periods.



Requires use of a little muscle force above the waist to hold up or move the body weight or objects for a short time.

## LOWER BODY DYNAMIC STRENGTH

This is the ability of the muscles of the lower part of the body (i.e., below the waist) to exert force repeatedly or continuously over a long time period. This is the ability to support, hold up, or move the body's own weight and/or objects repeatedly over time. It represents muscular endurance and emphasizes the resistance of the muscles in the feet and legs to fatigue.

### HOW DYNAMIC STRENGTH IS DIFFERENT FROM OTHER ABILITIES:

Hold up or move one's body weight or objects repeatedly by continuously changing the position of the lower body parts to accomplish the task.

vs.

Static Strength: Exert a muscular force with the lower body parts for a brief time period. These body parts show little or no movement.

Use one's lower body muscles to continuously (e.g., more than 10 seconds) hold up an object or support one's body weight.

vs.

Explosive Strength: Use of short bursts of muscle force that involve rapid movement of one or more of the lower body parts.

Hold up one's entire body weight with the feet and legs.

vs.

Trunk Strength: Hold up or move part, not all, of one's body, using mainly stomach and lower back muscles.

Involves the ability of the muscles of the lower body to repeatedly exert force over a long time period.

vs.

Stamina: The ability to perform a physical task without getting out of breath.

## LOWER BODY DYNAMIC STRENGTH

Requires use of all maximum muscle force below the waist to hold up or move the body weight or objects for long periods.



Climb a 6,000 ft. mountain.

Pedal a bicycle on a flat road for an hour.

Climb a 20 ft. ladder.

Requires use of a little muscle force below the waist to hold up or move the body weight or objects for a short time

## UPPER BODY EXPLOSIVE STRENGTH

This is the ability to use short bursts of muscle force in the upper part of the body (i.e., above the waist) to propel oneself or an object. It requires gathering energy for bursts of muscle effort over a very short time period. This ability involves the muscles located in the hands, arms, upper back, and shoulders.

### HOW EXPLOSIVE STRENGTH IS DIFFERENT FROM OTHER ABILITIES:

Use of short bursts of muscle force in the upper body to move an object (e.g., striking a nail with a hammer or throwing a softball).

vs.

Dynamic Strength: Use of repeated upper body muscle force over long time periods to hold up an object or one's body.

Involves a very rapid movement of one or more of the upper body parts in order to move an object or one's own body.

vs.

Static Strength: Does not involve rapid movement of an upper body part, but rather a slow continuous movement as used in a lifting action.

A motion in which one or more of the upper body parts are moving at a high speed (e.g., striking an object).

vs.

Trunk Strength: Hold up or move part, not all, of one's body, using mainly stomach and lower back muscles.

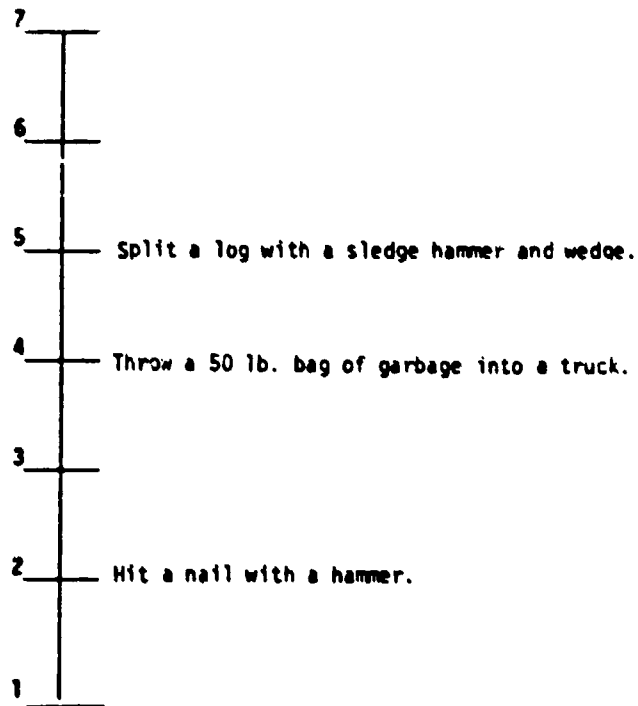
Involves the ability of the upper body muscles to exert a momentary force.

vs.

Stamina: The ability to perform a physical task without getting out of breath.

## UPPER BODY EXPLOSIVE STRENGTH

Requires bursts of maximum muscle force above the waist to propel one's own body weight or objects.



Requires bursts of a little muscle force above the waist to move one's own body weight or objects.

## LOWER BODY EXPLOSIVE STRENGTH

This is the ability to use short bursts of muscle force in the lower part of the body (i.e., below the waist) to propel oneself or an object. It requires gathering energy for bursts of muscle effort over a very short time period. This ability involves the muscles located in the feet and legs.

### HOW EXPLOSIVE STRENGTH IS DIFFERENT FROM OTHER ABILITIES:

Use of short bursts of muscle force in the lower body to move an object or the body (e.g., kicking a football or jumping into the air).

vs. Dynamic Strength: Use of repeated lower body muscle force over long time periods to hold up an object or one's body.

Involves a very rapid movement of one or more of the lower body parts in order to move an object or one's own body.

vs. Static Strength: Does not involve rapid movement of a lower body part, but rather a slow continuous movement as used in a lifting action.

A motion in which one or more of the lower body parts are moving at a high speed (e.g., striking an object).

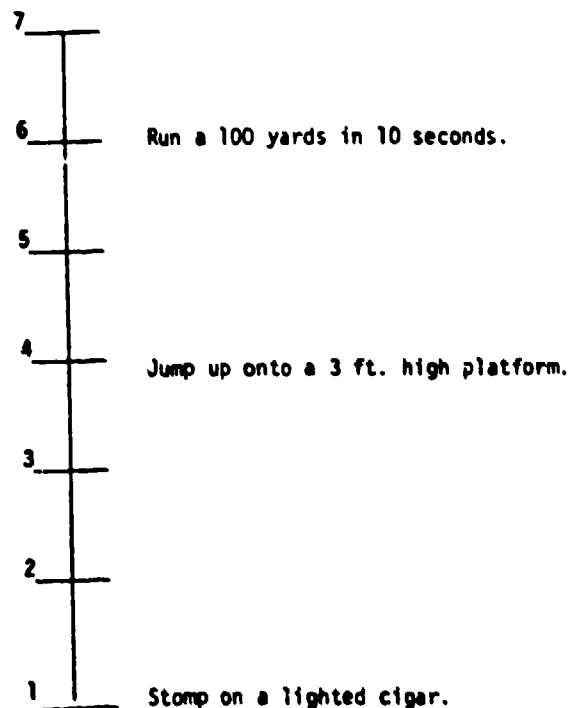
vs. Trunk Strength: Hold up or move part, not all of one's body using mainly stomach and lower back muscles.

Involves the ability of the lower body muscles to exert a momentary force.

vs. Stamina: The ability to perform a physical task without getting out of breath.

## LOWER BODY EXPLOSIVE STRENGTH

Requires bursts of maximum muscle force below the waist necessary to propel one's own body weight or objects.



Requires bursts of a little muscle force below the waist to move one's own body weight or objects.

## TRUNK STRENGTH

This ability involves the degree to which one's stomach and lower back muscles can support part of the body repeatedly or continuously over time. The ability involves the degree to which these trunk muscles do not "give out," or fatigue, when they are put under such repeated or continuous strain.

### HOW TRUNK STRENGTH IS DIFFERENT FROM OTHER ABILITIES

Use the stomach and lower back muscles to continuously hold up or move part of one's body.

vs.

Dynamic Strength: Hold up or move one's entire body weight with the hands, arms, and shoulders or with the feet and legs.

Hold up or move part of one's body weight with the trunk muscles.

vs.

Static Strength: Exert a muscular force with either the upper or lower body parts in order to apply force to an object.

Use the stomach and lower back muscles to hold up or move part of one's body.

vs.

Explosive Strength: Use of short bursts of muscle force that involve rapid movement of either the upper or lower body parts.

Involves the ability of the muscles of the stomach and lower back to repeatedly exert force over a long time period.

vs.

Stamina: The ability to perform a physical task without getting out of breath.

## TRUNK STRENGTH

Requires use of all the stomach and lower back muscle force possible to hold up or move part of your body for as long as possible.



Do 100 sit-ups.

Lean out from a step ladder to hang heavy floor length drapes.

Bend over to get a chemical sample of pool water.

Requires use of a little stomach and lower back muscle force to hold up or move part of your body for a short time.

## STAMINA

This is the ability of the lungs and circulatory (blood) systems of the body to perform efficiently over long time periods. This is the ability to exert oneself physically without getting out of breath.

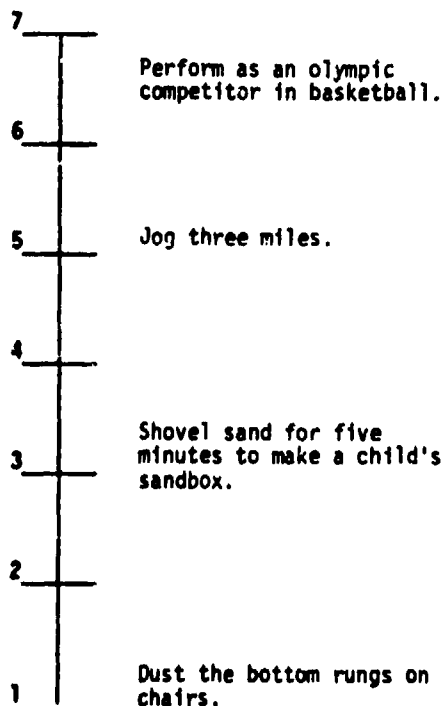
### HOW STAMINA IS DIFFERENT FROM OTHER ABILITIES:

Involves the ability of the lungs to perform efficiently over a long time period in order to resist getting out of breath. vs. Dynamic Strength: Involves the ability of the muscles of the body to repeatedly exert force over a long time period.

Involves the lungs and circulatory (blood) systems. vs. Static, Trunk and Explosive Strength: Involve the muscles.

## STAMINA

Requires physical activity of the whole body over a long time, with great strain on the heart, blood vessels, and lungs.



Requires physical activity of the whole body over a short time with little strain on the heart, blood vessels, and lungs

## FLEXIBILITY

This is the ability to bend, stretch, twist, or reach out with the body, arms or legs.

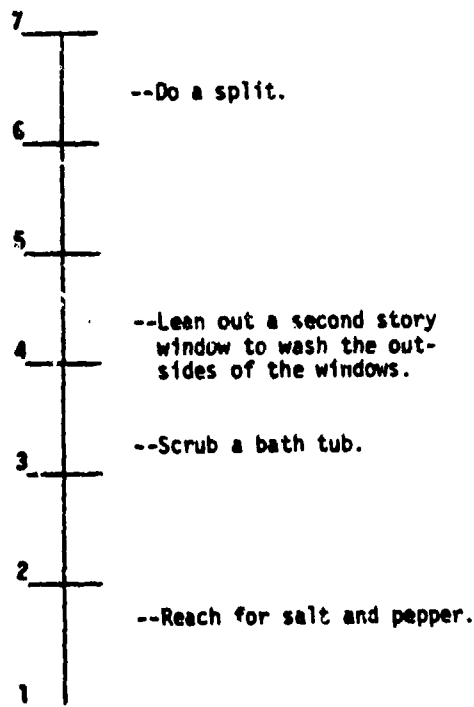
### HOW FLEXIBILITY IS DIFFERENT FROM OTHER ABILITIES:

Involves the ability of the arms, legs, and back to move in all directions without feeling "tight" or being able to move to a desired position (e.g., toe touching, reaching high above one's head, crawling through a very small space).

vs. Strength Factors: The ability of the muscles to exert a force.

## FLEXIBILITY

Requires a high degree of bending, stretching, twisting or reaching out into unusual positions.



Requires a low degree of bending, stretching, twisting or reaching out.

## EQUILIBRIUM

The ability to keep or regain one's body balance, or to stay upright when in an unstable position. This ability includes being able to maintain one's balance when changing direction while moving or when standing motionless.

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## EQUILIBRIUM

Requires keeping or getting back on balance when many forces are working against keeping body balance. These forces work randomly so that one cannot tell when the next force will act on him, how long it will last or how strong it will be.



Work on high rise construction.

Descend from a large tree after trimming branches.

Stretch out to polish the center part of a car roof (large car).

Walk through a doorway.

Requires keeping or getting back balance when one force which is fairly weak works against your body balance.



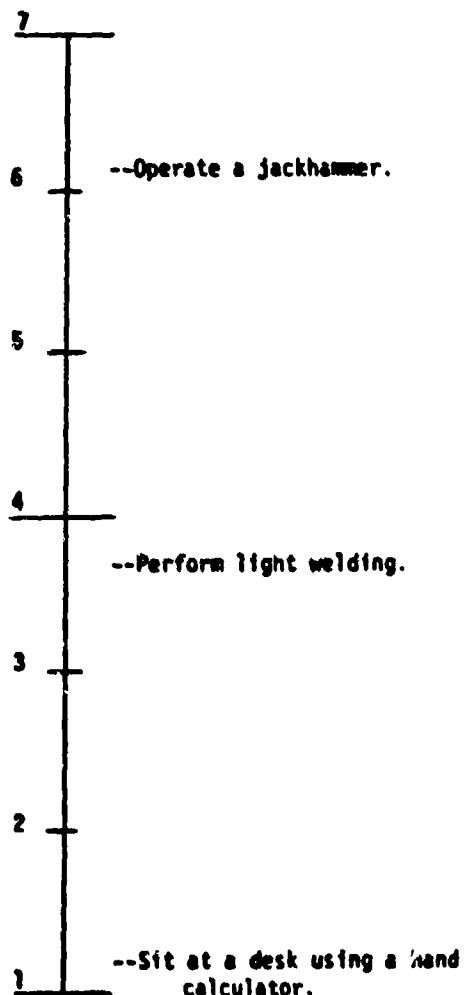
# **EFFORT**

This is the overall degree of physical exertion experienced in performing either a single task or a series of tasks.

## **EFFORT**

Requires extensive  
physical exertion.

Requires little  
physical exertion.



APPENDIX F

RESULTS OF FLEXIBILITY  
SCALE RESEARCH

# APPENDIX F. DESCRIPTIVE STATISTICS FOR FLEXIBILITY SCALE ANCHORS

1. Shovel gravel for 15 minutes to cover a 20' driveway.	3.1 (1.4)
2. Reach for salt and pepper.	1.7 (0.9)
3. Perform as an olympic competitor in basketball.	5.4 (1.6)
4. Push a car on level ground.	2.1 (1.0)
5. Paint a 10' x 12' ceiling from a ladder covering the area without moving the ladder.	5.1 (1.6)
6. Scrub floors on hands and knees.	2.9 (1.3)
7. Lift heavy grocery bags out of the shopping cart and place in the back seat of the car.	2.9 (1.2)
8. Tie string/rope around a 40 lb. package.	1.9 (1.1)
9. Lean out a second story window to wash the outsides of the windows.	4.4 (1.4)
10. Strip or make a bed.	2.4 (1.1)
11. Stock grocery store shelves from a step stool.	3.3 (1.3)
12. Walk across a sloping roof carrying a TV antenna.	2.8 (1.4)
13. Shovel sand for five minutes to make a child's sandbox.	2.7 (1.2)
14. Stretch out to polish the center part of a car roof (large car).	4.2 (1.5)
15. Do one hundred sit-ups.	3.3 (1.3)
16. Pull clothes out of a washing machine and place into a front loading dryer.	2.3 (1.0)
17. Pull a 50 gallon trash can full of dirt and weeds from the back yard to the curb.	2.3 (1.1)
18. Dress or undress.	2.6 (1.3)
19. Load bags of cement (90 lbs.) into a mixer.	2.8 (1.1)
20. Plant seeds in a garden for two hours.	2.9 (1.2)
21. Work on high rise construction.	3.9 (1.4)
22. Bend over to touch your toes.	5.3 (1.4)

APPENDIX F. DESCRIPTIVE STATISTICS FOR FLEXIBILITY SCALE ANCHORS (continued)

23. Descend from branches after trimming a large tree.	4.4 (1.5)
24. Scrub a bath tub.	3.3 (1.2)
25. Lean out a second story window to put in storm windows.	4.5 (1.4)
26. Dust the bottom rungs on chairs.	3.0 (1.2)
27. Get around an obstacle course with no time limit.	3.8 (1.5)
28. Bend over to get a chemical sample of pool water.	3.3 (1.3)
29. Run up two flights of stairs to answer phone.	2.3 (1.3)
30. Stretch out to wash the center part of a car roof (large car).	4.3 (1.5)
31. Walk through a doorway.	1.1 (0.4)
32. Lean out from a step ladder to hang heavy floor length drapes.	3.9 (1.3)
33. Walk along the top of a 3' high brick wall.	1.8 (1.0)
34. Mow a small lawn with a power mower.	1.9 (0.8)
35. Lean over the sink to wash your hair.	2.6 (1.1)
36. Wash a chalkboard.	2.3 (1.1)
37. Lay carpet.	3.3 (1.1)
38. Dig ditches all day.	4.0 (1.5)
39. Pull weeds in a garden for 30 minutes.	3.3 (1.5)
40. Fill a bag with shells at the sea shore.	2.7 (1.3)
41. Saw dead wood.	2.5 (1.1)
42. Install ceiling panels.	4.4 (1.5)
43. Do a split.	6.5 (0.9)

APPENDIX G

RESULTS OF THE PAA RATINGS

The column headings for the tables in this appendix have been abbreviated as follows:

Upper Body Static Strength . . . . .	.UBSS
Lower Body Static Strength . . . . .	.LBSS
Upper Body Dynamic Strength. . . . .	.UBDS
Lower Body Dynamic Strength. . . . .	.LBDS
Upper Body Explosive Strength. . . . .	.UBES
Lower Body Explosive Strength. . . . .	.LBES
Trunk Strength . . . . .	.TS
Stamina. . . . .	.S
Flexibility. . . . .	.FLEX
Equilibrium. . . . .	.EQ
Effort . . . . .	.EFF

TABLE G-1 INCUMBENT BOATSWAIN'S MATES' MEAN TASK RATINGS BY ABILITIES AND EFFORT

UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
5.7 (1.0)	4.8 (1.6)	4.7 (1.7)	4.1 (1.9)	4.3 (2.0)	4.3 (1.8)	4.2 (1.9)	3.7 (1.7)	3.5 (1.6)	3.4 (1.9)	4.9 (1.3)
5.6 (1.4)	5.2 (1.2)	5.3 (1.3)	4.7 (1.5)	4.3 (1.4)	4.6 (1.4)	4.1 (1.4)	4.1 (0.7)	3.8 (1.4)	3.8 (1.8)	5.0 (1.3)
4.3 (1.4)	3.2 (1.6)	3.6 (1.8)	3.0 (1.9)	3.4 (1.6)	3.0 (1.4)	3.4 (1.5)	2.5 (0.9)	3.4 (1.5)	3.4 (1.5)	4.1 (1.4)
6.5 (1.2)	5.8 (1.1)	5.7 (1.3)	4.4 (1.5)	5.2 (1.4)	4.7 (1.3)	4.2 (1.8)	3.9 (1.2)	3.4 (1.7)	3.4 (1.8)	5.5 (1.1)
2.2 (1.1)	2.3 (1.3)	2.6 (1.3)	2.3 (1.3)	2.5 (1.1)	2.4 (1.6)	2.2 (1.3)	2.1 (0.8)	2.0 (1.2)	2.7 (1.6)	3.0 (1.4)
3.4 (0.9)	3.2 (1.4)	3.2 (1.3)	2.7 (1.6)	3.2 (1.4)	3.0 (1.8)	3.2 (1.4)	2.4 (1.0)	2.7 (1.1)	2.7 (1.5)	3.4 (1.6)
4.4 (1.3)	4.4 (1.5)	4.2 (1.6)	3.7 (1.7)	3.9 (1.3)	3.9 (1.5)	3.8 (1.3)	3.5 (1.1)	3.4 (1.3)	3.1 (1.4)	4.6 (1.3)
3.2 (1.3)	2.7 (1.4)	3.3 (1.6)	2.6 (1.9)	3.1 (1.6)	3.2 (1.4)	2.9 (1.7)	2.7 (1.1)	2.9 (1.3)	3.1 (1.5)	3.4 (1.2)
6.2 (0.9)	5.2 (1.4)	5.2 (1.3)	4.3 (1.5)	4.3 (1.6)	4.1 (1.3)	5.0 (1.6)	4.6 (1.3)	3.8 (1.7)	3.9 (1.6)	5.3 (1.3)
5.5 (1.0)	4.0 (1.7)	4.7 (1.2)	3.4 (1.4)	3.9 (1.4)	3.4 (1.4)	3.6 (1.5)	3.1 (1.2)	3.4 (1.3)	3.6 (1.5)	4.1 (0.6)
4.0 (1.3)	2.6 (1.6)	4.2 (1.8)	2.9 (1.4)	3.0 (1.8)	2.6 (1.3)	2.9 (1.5)	2.9 (1.7)	2.9 (1.5)	2.5 (1.7)	3.7 (1.3)
4.8 (1.6)	4.3 (1.4)	4.1 (1.5)	3.3 (1.6)	4.0 (1.3)	3.4 (1.3)	3.4 (1.1)	3.4 (1.4)	3.2 (1.3)	3.6 (1.5)	3.7 (1.2)
5.7 (1.5)	4.8 (1.6)	4.5 (2.0)	4.1 (1.9)	4.1 (1.7)	3.8 (1.7)	4.2 (1.3)	3.9 (1.4)	3.0 (1.7)	3.5 (1.7)	4.4 (1.2)
3.9 (1.3)	3.4 (1.4)	3.6 (1.5)	3.1 (1.5)	3.1 (1.6)	2.6 (1.5)	3.2 (1.2)	2.6 (1.1)	3.3 (1.0)	3.5 (1.8)	3.5 (0.9)
4.6 (1.1)	3.7 (1.6)	4.1 (1.5)	3.3 (1.5)	3.5 (1.9)	3.1 (1.8)	2.9 (1.4)	2.8 (1.2)	2.8 (1.3)	3.1 (1.6)	3.8 (1.5)
5.6 (1.8)	4.8 (1.9)	4.6 (2.0)	4.3 (1.4)	4.8 (1.7)	4.1 (1.7)	4.4 (1.7)	3.8 (1.5)	3.4 (1.5)	3.1 (1.8)	4.8 (1.3)

• Stream probe refueling to a destroyer.

1. Breakout tool box.
2. Fifteen people pull messenger phone lines and span wire on board.
3. Connect span wire to fixed padeye with pelican hook.
4. Give hard pull for last several feet so that probe seats into probe receiver.
5. Rig easing out line.

• Getting underway

6. Remove mooring lines by flipping off of the bollard (2 people).
7. Haul mooring line back aboard ship with 6 people.

• General tasks.

8. During an UNREP release slings from cargo drop reel to allow for its return to the delivery ship.
9. One person load 15 5-gallon cans of paint into storage bins.
10. Rig boatswain chair and hoist seaman aloft.
11. Chip paint with pneumatic tool (e.g., deck crawler, knuckle buster, needle gun) for two hours.
12. Rig chainfall to fixed padeye for removing compressor from a walk-in refrigerator.
13. Pull/slack mooring line from ship to pier by hand (2 people).
14. Rig SAV-ALL safety net under brow.
15. Bolt (marry) causeways together.
16. After performing PMS on anchor chain, replace chain to appropriate position in chain locker.

TABLE G-1 INCUMBENT BOATSWAIN'S MATES' MEAN TASK RATINGS BY ABILITIES AND EFFORT (continued)

UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
4.9 (1.5)	3.7 (1.3)	4.6 (1.4)	3.6 (1.7)	4.1 (1.8)	3.6 (1.7)	4.0 (1.5)	3.6 (1.5)	3.8 (1.8)	3.8 (2.0)	4.5 (1.3)
4.5 (1.6)	3.5 (1.4)	4.1 (1.8)	3.7 (1.8)	3.8 (1.6)	3.7 (1.6)	3.6 (1.0)	3.2 (1.3)	3.7 (1.8)	3.5 (1.5)	4.2 (1.2)
3.8 (1.4)	3.5 (1.2)	3.8 (1.7)	3.2 (1.7)	3.5 (1.5)	3.0 (1.3)	3.2 (1.0)	2.8 (1.1)	3.1 (1.3)	3.2 (1.4)	3.2 (0.8)
5.0 (1.5)	4.6 (1.6)	4.6 (1.4)	4.2 (1.5)	4.2 (1.5)	4.2 (1.7)	4.3 (1.6)	4.0 (1.3)	3.3 (2.0)	4.1 (1.8)	4.8 (1.3)
5.0 (1.0)	4.4 (1.2)	3.9 (1.4)	3.7 (1.3)	3.8 (1.3)	3.9 (1.6)	3.7 (1.2)	3.6 (1.3)	3.3 (1.6)	3.4 (1.9)	4.2 (1.3)
4.9 (1.1)	4.2 (1.4)	4.2 (1.5)	4.1 (1.4)	3.7 (1.5)	3.7 (1.5)	3.8 (0.9)	3.6 (1.3)	3.1 (1.5)	3.0 (1.5)	4.2 (1.1)
5.8 (1.2)	4.4 (1.9)	4.8 (1.7)	3.8 (1.7)	4.7 (2.1)	4.4 (1.8)	4.3 (1.5)	3.9 (1.6)	3.7 (2.1)	3.9 (2.1)	4.3 (1.7)

17. Serve as first loader on 3" - 50 gun.
18. Obtain appropriate fire extinguisher and/or hose and begin to fight a Class Alpha fire.
19. Open and close non-counter balanced scuttles in the overhead.
20. Breakout ammo from magazine and take up two decks to ready service locker.
21. During VERTREP, assemble 6-8 pallets, nets and retrograde on drop zone for return to UNREP ship.
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefers).
23. Serve as projectile loader on 5" - 54 gun.



TABLE G-2 JOB ANALYSTS' MEAN RATINGS OF BOATSWAIN'S MATE TASKS BY ABILITIES AND EFFORT

	LBSS	LBDS	UBDS	LBDS	UBES	LDSE	TS	S	FLEX	EQ	EFF
• Stream probe refueling to a destroyer.											
1. Breakout tool box.	5.0 (0.0)	4.3 (0.6)	3.7 (0.6)	3.7 (1.5)	2.3 (0.6)	1.7 (0.6)	4.7 (0.6)	2.0 (0.0)	1.7 (0.6)	2.3 (1.2)	4.7 (0.6)
2. Fifteen people pull messenger phone lines and span wire on board.	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
3. Connect span wire to fixed padeye with pelican hook.	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
4. Give hard pull for last several feet so that probe seats into probe receiver.	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
5. Rig easing out line.	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
• Getting underway.											
6. Remove mooring lines by flipping off of the bollard (2 people).	3.0 (0.0)	1.7 (0.6)	1.3 (0.6)	1.3 (0.6)	2.3 (1.2)	1.7 (1.2)	2.0 (0.0)	1.0 (0.0)	1.7 (0.6)	2.7 (1.5)	2.3 (0.6)
7. Haul mooring line back aboard ship with 6 people.	3.0 (0.0)	2.0 (0.0)	3.0 (1.0)	1.7 (0.6)	2.0 (0.0)	1.7 (0.6)	2.0 (0.0)	2.3 (0.6)	1.7 (0.6)	2.3 (0.6)	3.0 (0.0)
• General tasks.											
8. During an UNREP release slings from cargo drop reel to allow for its return to the delivery ship.	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
9. One person load 15 5-gallon cans of paint into storage bins.	5.3 (0.6)	4.3 (0.6)	5.3 (0.6)	3.3 (0.6)	3.3 (0.6)	2.3 (0.6)	4.3 (0.6)	3.3 (0.6)	3.7 (1.5)	4.7 (0.6)	5.0 (1.0)
10. Rig boatswain chair and hoist seaman aloft.	4.0 (1.0)	2.3 (0.6)	4.3 (0.6)	2.0 (1.0)	3.0 (0.0)	1.3 (0.6)	3.3 (1.2)	2.7 (0.6)	2.7 (0.6)	2.0 (1.0)	4.0 (1.0)
11. Chip paint with pneumatic tool (e.g., deck crawler, knuckle buster, needle gun) for two hours.	2.7 (0.6)	1.3 (0.6)	3.7 (0.6)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	2.0 (0.0)	2.3 (0.6)	2.7 (0.6)	3.0 (1.0)	2.7 (0.6)
12. Rig chainfall to fixed padeye for removing compressor from a walk-in refrigerator.	5.7 (0.6)	4.0 (1.0)	3.7 (1.5)	2.7 (0.6)	2.7 (1.2)	1.3 (0.6)	4.0 (0.0)	2.3 (0.6)	2.3 (1.2)	2.7 (0.6)	4.7 (0.6)
13. Pull/slack mooring line from ship to pier by hand (2 people).	3.7 (0.6)	2.3 (1.2)	3.7 (0.6)	1.7 (0.6)	2.3 (0.6)	2.0 (0.0)	3.0 (1.0)	2.0 (0.0)	2.0 (1.0)	2.3 (0.6)	2.7 (0.6)
14. Rig SAV-ALL safety net under brow.	2.3 (0.6)	1.2 (0.6)	2.0 (0.0)	1.3 (0.6)	2.7 (1.5)	1.3 (0.6)	2.3 (1.2)	1.0 (0.0)	4.0 (1.0)	4.0 (0.0)	2.7 (0.6)
15. Bolt (marry) causeways together.	4.0 (1.0)	2.7 (1.2)	2.7 (0.6)	2.0 (0.0)	2.7 (1.5)	2.3 (1.5)	3.3 (1.5)	2.0 (0.0)	2.7 (1.5)	3.3 (1.5)	3.7 (1.2)
16. After performing PMS on anchor chain, replace chain to appropriate position in chain locker.	4.7 (0.6)	3.0 (1.7)	3.3 (1.2)	2.7 (1.2)	2.0 (1.0)	1.7 (0.6)	3.3 (1.2)	2.7 (0.6)	2.3 (0.6)	2.7 (0.6)	4.6 (1.0)

TABLE G-2 JOB ANALYSTS' MEAN RATINGS OF BOATSWAIN'S MATE TASKS BY ABILITIES AND EFFORT (continued)

UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
4.0 (0.0)	2.7 (0.6)	4.3 (1.2)	2.7 (0.6)	3.0 (1.0)	1.7 (0.6)	3.3 (0.6)	3.0 (1.0)	2.3 (0.6)	4.0 (1.0)	4.3 (0.6)
5.3 (0.6)	3.7 (0.6)	5.3 (0.6)	3.7 (0.6)	3.0 (0.0)	2.3 (0.6)	3.3 (0.6)	3.3 (0.6)	2.7 (0.6)	4.3 (0.6)	4.7 (0.6)
4.7 (0.6)	2.7 (0.6)	3.3 (0.6)	2.7 (0.6)	2.7 (0.6)	2.0 (1.0)	2.7 (0.6)	2.0 (1.0)	2.3 (0.6)	4.7 (0.6)	3.3 (0.6)
7.0 (0.0)	5.7 (0.6)	6.3 (0.6)	6.0 (1.0)	1.7 (0.6)	1.7 (0.6)	6.0 (0.6)	3.7 (1.2)	3.0 (1.0)	5.3 (0.6)	6.0 (0.0)
3.3 (0.6)	2.3 (0.6)	3.0 (0.0)	2.3 (0.6)	2.3 (1.5)	1.3 (0.6)	3.0 (0.0)	2.0 (1.0)	2.3 (0.6)	2.7 (0.6)	3.0 (0.0)
5.0 (0.0)	3.7 (0.6)	5.0 (0.0)	4.3 (0.6)	2.3 (0.6)	2.0 (0.0)	4.0 (1.0)	4.7 (0.6)	3.0 (0.0)	4.0 (1.0)	5.0 (0.0)
6.3 (0.6)	6.0 (0.0)	6.0 (0.0)	5.3 (1.2)	2.7 (0.6)	1.7 (0.6)	5.7 (0.6)	4.0 (1.0)	3.0 (1.0)	3.7 (1.2)	6.0 (0.0)

17. Serve as first loader on 3" - 50 gun.

18. Obtain appropriate fire extinguisher and/or hose and begin to fight a Class Alpha fire.

19. Open and close non-counter balanced scuttles in the overhead.

20. Breakout ammo from magazine and take up two decks to ready service locker.

21. During VERTREP, assemble 6-8 pallets, nets and retrograde on drop zone for return to UNREP ship.

22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefers).

23. Serve as projectile loader on 5" - 54 gun.

TABLE G-3 INCUMBENT GUNNER'S MATES' MEAN TASK RATINGS BY ACILITIES AND EFFORT

UBSS	LBSS	UBUS	LBUS	UBES	LBES	TS	S	FLEX	EQ	EFF
3.1 (1.0)	3.1 (1.0)	2.8 (0.8)	3.1 (1.4)	2.3 (0.9)	2.6 (1.0)	2.7 (0.9)	2.3 (1.1)	4.4 (1.5)	3.1 (2.0)	3.6 (1.6)
5.5 (1.3)	4.4 (1.6)	4.3 (1.2)	3.9 (1.4)	3.4 (1.4)	3.2 (1.9)	3.9 (1.8)	3.4 (2.0)	4.1 (1.3)	3.9 (1.5)	4.6 (1.4)
5.5 (1.1)	4.4 (1.7)	4.6 (1.0)	3.6 (1.4)	3.5 (1.0)	3.2 (1.8)	3.9 (1.6)	3.3 (1.7)	3.9 (1.4)	4.3 (1.4)	4.6 (1.1)
2.8 (0.9)	3.3 (1.1)	3.0 (1.2)	3.2 (1.3)	2.9 (1.1)	2.9 (1.3)	3.1 (1.5)	3.1 (1.6)	3.2 (1.5)	3.1 (1.0)	3.8 (1.1)
3.2 (1.1)	2.3 (1.0)	3.4 (1.3)	2.5 (1.1)	2.9 (1.1)	2.0 (1.3)	2.6 (1.5)	2.2 (1.3)	2.4 (1.2)	2.4 (1.2)	3.4 (1.3)
5.6 (1.0)	4.7 (1.3)	4.4 (1.2)	4.1 (1.1)	4.1 (1.0)	4.1 (1.3)	4.3 (1.7)	4.5 (1.5)	4.1 (1.5)	4.1 (1.5)	5.4 (1.2)
5.4 (1.4)	4.2 (1.1)	4.5 (1.3)	3.5 (1.0)	3.7 (0.9)	3.4 (1.7)	4.0 (1.6)	3.7 (1.5)	4.0 (1.3)	3.7 (1.3)	5.4 (1.0)
2.8 (1.3)	2.5 (1.4)	2.5 (1.1)	1.9 (1.0)	1.8 (0.8)	1.8 (1.0)	2.2 (1.1)	2.0 (1.1)	2.9 (1.4)	2.9 (1.7)	2.7 (1.2)
5.1 (1.1)	4.4 (1.4)	4.6 (1.5)	4.2 (1.0)	4.1 (1.4)	3.7 (1.5)	4.4 (1.4)	4.1 (1.5)	4.0 (1.5)	4.3 (1.4)	5.0 (1.5)
5.4 (0.7)	4.7 (1.3)	4.8 (1.1)	4.5 (1.0)	4.5 (1.6)	4.4 (1.3)	4.8 (1.2)	5.0 (1.1)	4.5 (1.6)	4.5 (1.5)	5.3 (1.3)
3.5 (1.7)	3.1 (1.5)	3.7 (1.9)	3.1 (1.5)	3.0 (1.7)	2.6 (1.6)	2.9 (1.5)	2.9 (1.4)	3.0 (1.7)	3.2 (1.8)	3.6 (1.6)
5.8 (0.8)	5.1 (1.6)	5.6 (0.9)	5.2 (1.1)	4.5 (1.8)	4.6 (1.6)	5.0 (1.4)	5.2 (1.2)	3.9 (1.7)	4.5 (1.8)	5.8 (1.1)
5.8 (1.0)	4.7 (1.6)	5.5 (1.2)	4.7 (1.4)	5.1 (1.1)	4.3 (1.4)	5.1 (1.3)	5.1 (1.5)	4.3 (1.3)	4.4 (1.3)	5.6 (1.1)
3.1 (1.2)	2.4 (1.1)	3.1 (1.0)	2.3 (1.0)	2.9 (1.1)	2.4 (1.1)	2.3 (1.0)	2.4 (1.0)	3.4 (1.3)	3.1 (1.5)	3.4 (1.2)
2.2 (0.9)	2.2 (1.2)	2.2 (1.0)	1.8 (0.6)	2.1 (1.3)	1.9 (0.9)	1.9 (0.7)	1.8 (0.9)	3.1 (1.3)	2.6 (1.4)	2.8 (1.0)
5.0 (1.3)	3.8 (1.9)	4.5 (1.5)	3.9 (1.1)	4.1 (1.4)	3.8 (1.4)	3.9 (1.4)	4.0 (1.4)	4.1 (1.5)	3.9 (1.6)	4.4 (1.5)

- PMS on breech block (175#) 3" - 50 gun.
  1. Crawl into appropriate area to perform PMS.
  2. Second GM reaches in and removes block from first GM.
  3. Replace breech block on 3" - 50 gun by having one GM attach winch, lower block to other GM.
- During VERTREP.
  4. Lay out cargo nets for receiving pallets from forklift.
  5. Cut banding from pallets
- General tasks.
  6. Remove loader driver motor for PMS.
  7. Release counter recoil spring on 3" - 50 gun.
  8. Check and make fine adjustments on 3" power drive.
  9. Load 5" mortar with rapid blooming off-board chaff.
  10. Load 3" - 50 gun during combat/gun shoot.
  11. Use ammo hoist to lower munitions for 5" - 54 gun to magazine deck.
  12. Carry munitions for 5" - 54 gun from starting area across deck to ladder.
  13. Place projectiles for 5" - 54 gun in racks.
  14. Plug a small hole in the bulkhead with a piece of soft wood.
  15. Repair and adjust components of the control panels (e.g., circuit breakers, etc.).
  16. To patch large hole in bulkhead, shore up the deck from the next lower deck.

TABLE G-3 INCUMBENT GUNNER'S MATES' MEAN TASK RATINGS BY ABILITIES AND EFFORT (continued)

	UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
17. Control ruptured LP pipeline.	4.4 (1.6)	3.2 (1.5)	3.9 (1.5)	2.7 (0.9)	3.4 (1.3)	2.7 (1.2)	3.0 (1.2)	2.9 (1.2)	3.2 (1.2)	3.3 (0.8)	3.9 (1.1)
18. Obtain appropriate fire extinguisher and begin to fight Class Alpha fire.	4.1 (1.4)	3.9 (1.7)	3.8 (1.3)	3.8 (1.6)	3.4 (1.7)	3.9 (1.7)	3.8 (1.6)	3.8 (1.9)	3.7 (1.6)	3.5 (1.5)	4.2 (1.8)
19. Open and close non-counter balanced scuttles in the overhead.	4.1 (1.3)	3.4 (1.5)	4.0 (1.2)	3.1 (1.1)	3.5 (0.8)	3.5 (1.2)	3.5 (1.1)	3.1 (1.4)	3.7 (1.3)	3.8 (1.2)	4.1 (1.0)
20. Pass boxes of small arms ammo down two decks (2 people).	5.5 (1.2)	4.3 (1.6)	5.2 (1.2)	4.5 (1.5)	3.9 (1.6)	4.1 (1.7)	4.6 (1.7)	4.5 (1.8)	4.4 (1.3)	4.7 (1.4)	5.1 (1.5)
21. During VERTREP, assemble 6-8 pallets, ncts, and retrograde on drop zone for return to UNREP ship.	4.9 (1.1)	3.9 (1.1)	4.7 (1.1)	4.4 (1.1)	3.3 (1.3)	3.6 (1.5)	4.6 (1.2)	4.3 (1.3)	3.7 (1.4)	3.4 (1.3)	4.9 (1.0)
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefer).	4.9 (1.4)	4.1 (1.3)	4.8 (1.0)	4.4 (1.3)	3.7 (1.3)	3.8 (1.7)	4.3 (1.3)	4.3 (1.3)	4.1 (1.5)	3.6 (1.2)	4.7 (1.2)
23. Load projectiles for a 5" - 54 gun Mark 42.	5.9 (0.9)	4.9 (1.3)	5.9 (0.8)	5.3 (1.2)	5.0 (1.4)	4.6 (1.7)	5.2 (1.3)	5.5 (1.4)	4.4 (1.6)	4.6 (1.4)	5.9 (0.9)

TABLE G-4 JOB ANALYSTS' MEAN RATINGS OF GUNNER'S MATE TASKS BY ABILITIES AND EFFORT

UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
1.3 (0.6)	1.7 (0.6)	1.3 (0.6)	1.3 (0.6)	1.0 (0.0)	1.3 (0.6)	2.7 (1.2)	1.0 (0.0)	3.3 (1.2)	2.0 (1.0)	2.0 (0.0)
6.0 (0.0)	4.0 (0.0)	3.7 (0.6)	2.7 (0.6)	1.3 (0.6)	1.3 (0.6)	4.7 (0.6)	1.7 (0.6)	2.0 (1.0)	3.0 (1.0)	5.0 (0.0)
5.0 (1.0)	3.3 (1.2)	3.3 (0.6)	2.0 (0.0)	1.3 (0.6)	1.3 (0.6)	4.3 (1.5)	1.7 (0.6)	3.0 (1.7)	2.7 (1.2)	4.7 (1.2)
3.0 (0.0)	2.3 (0.6)	3.0 (1.0)	2.0 (1.0)	1.3 (0.6)	1.3 (0.6)	2.7 (0.6)	1.7 (0.6)	2.0 (0.0)	2.0 (1.0)	2.3 (0.6)
3.0 (1.0)	2.3 (1.2)	2.3 (0.6)	1.7 (0.6)	2.7 (0.6)	1.0 (0.0)	2.0 (0.0)	1.3 (0.6)	1.7 (0.6)	2.0 (0.0)	2.7 (0.6)
4.0 (1.0)	3.0 (1.0)	3.3 (0.6)	2.3 (0.6)	2.3 (0.6)	1.3 (0.6)	3.3 (0.6)	2.0 (0.0)	2.3 (0.6)	3.0 (1.0)	4.0 (1.0)
4.7 (0.6)	3.3 (0.6)	3.3 (0.6)	2.0 (0.0)	2.0 (0.0)	1.7 (0.6)	4.0 (0.0)	2.0 (0.0)	2.3 (0.6)	2.0 (0.0)	3.7 (0.6)
1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	2.0 (1.0)	1.0 (0.0)	2.3 (0.6)	2.0 (1.0)	1.0 (0.0)
4.7 (0.6)	3.3 (0.6)	3.3 (0.6)	2.7 (0.6)	2.0 (0.0)	1.7 (0.6)	3.7 (1.2)	2.0 (0.0)	2.3 (0.6)	3.0 (1.0)	3.7 (0.6)
4.0 (0.0)	2.7 (0.6)	4.3 (1.2)	2.7 (0.6)	3.0 (1.0)	1.7 (0.6)	3.3 (0.6)	3.0 (1.0)	2.3 (0.6)	4.0 (1.0)	4.3 (0.6)
2.3 (0.6)	2.0 (0.0)	2.0 (0.0)	1.7 (0.6)	1.0 (0.0)	1.0 (0.0)	2.3 (0.6)	1.3 (0.6)	2.3 (0.6)	2.3 (0.6)	2.0 (0.0)
6.3 (0.6)	5.0 (1.0)	5.3 (0.6)	4.7 (1.5)	2.3 (0.6)	2.0 (0.0)	5.3 (0.6)	3.7 (0.6)	3.0 (1.0)	4.0 (0.0)	6.0 (0.0)
6.3 (0.6)	5.0 (1.7)	5.7 (0.6)	4.7 (1.5)	2.0 (0.0)	2.0 (0.0)	5.0 (0.0)	4.0 (1.0)	4.0 (0.0)	4.3 (0.6)	5.7 (0.6)
2.3 (0.6)	1.3 (0.6)	2.7 (0.6)	1.7 (0.6)	2.7 (0.6)	1.3 (0.6)	1.7 (0.6)	1.3 (0.6)	2.3 (0.6)	3.0 (0.0)	2.3 (0.6)
1.7 (0.6)	1.0 (0.0)	1.7 (0.6)	1.0 (0.0)	1.3 (0.6)	1.0 (0.0)	2.0 (1.0)	1.0 (0.0)	2.7 (0.6)	1.7 (0.6)	1.3 (0.6)
4.0 (0.0)	3.0 (0.0)	3.0 (1.0)	2.3 (0.6)	2.3 (0.6)	1.7 (0.6)	3.0 (0.0)	2.3 (0.6)	2.3 (0.6)	3.0 (0.0)	3.7 (0.6)

● PMS on breech block (175#) 3" - 50 gun.

1. Crawl into appropriate area to perform PMS.
2. Second GM reaches in and removes block from first GM.
3. Replace breech block on 3" - 50 gun by having one GM attach winch, lower block to other GM.

● During VERTREP.

4. Lay out cargo nets for receiving pallets from forklift.

● Cut banding from pallets

● General tasks.

6. Remove loader driver motor for PMS.
7. Release counter recoil spring on 3" - 50 gun.

8. Check and make fine adjustments on 3" power drive.

9. Load 5" mortar with rapid blooming off-board chaff.

10. Load 3" - 50 gun during combat/gun shoot.

11. Use ammo hoist to lower munitions for 5" - 54 gun to magazine deck.

12. Carry munitions for 5" - 54 gun from stajing area across deck to ladder.

13. Place projectiles for 5" - 54 gun in racks.

14. Plug a small hole in the bulkhead with a piece of soft wood.

15. Repair and adjust components of the control panels (e.g., circuit breakers, etc.).

16. To patch large hole in bulkhead, shore up the deck from the next lower deck.

TABLE G-4 JOB ANALYSTS' MEAN RATINGS OF GUNNER'S MATE TASKS BY ABILITIES AND EFFORT (continued)

	UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
17. Control ruptured LP pipeline.	3.0 (1.0)	2.0 (0.0)	3.0 (1.0)	2.0 (0.0)	2.3 (1.5)	1.7 (0.6)	2.3 (0.6)	1.7 (1.2)	2.3 (1.2)	3.7 (0.6)	2.7 (0.6)
18. Obtain appropriate fire extinguisher and begin to fight Class Alpha fire.	5.3 (0.6)	3.7 (0.6)	5.3 (0.6)	3.7 (0.6)	3.0 (0.0)	2.3 (0.6)	3.3 (0.6)	3.3 (0.6)	2.7 (0.6)	4.3 (0.6)	4.7 (0.6)
19. Open and close non-counter balanced scuttles in the overhead.	4.7 (0.6)	2.7 (0.6)	3.3 (0.6)	2.7 (0.6)	2.7 (0.6)	2.0 (1.0)	2.7 (0.6)	2.0 (1.0)	2.3 (0.6)	4.7 (0.6)	3.3 (0.6)
20. Pass boxes of small arms ammo down two decks (2 people).	7.0 (0.0)	5.7 (0.6)	6.3 (0.6)	6.0 (1.0)	1.7 (0.6)	1.7 (0.6)	6.0 (0.0)	3.7 (1.2)	3.0 (1.0)	5.3 (0.6)	6.0 (0.0)
21. During VERTREP, assemble 6-8 pallets, nets, and retrograde on drop zone for return to UNREP ship.	3.3 (0.6)	2.3 (0.6)	3.0 (0.0)	2.3 (0.6)	2.3 (1.5)	1.3 (0.6)	3.0 (0.0)	2.0 (1.0)	2.3 (0.6)	2.7 (0.6)	3.0 (0.0)
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefer).	5.0 (0.0)	3.7 (0.6)	5.0 (0.0)	4.3 (0.6)	2.3 (0.6)	2.0 (0.0)	4.0 (1.0)	4.7 (0.6)	3.0 (0.0)	4.0 (1.0)	5.0 (0.0)
23. Load projectiles for a 5" - 54 gun Mark 42.	6.3 (0.6)	6.0 (0.0)	6.0 (0.0)	5.3 (1.2)	2.7 (0.6)	1.7 (0.6)	5.7 (0.6)	4.0 (1.0)	3.0 (1.0)	3.7 (1.2)	6.0 (0.0)

TABLE G-5 INCUMBENT HULL TECHNICIANS' MEAN TASK RATINGS BY ABILITIES AND EFFORT

	UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
1. Remove and replace an overhead valve for 4" diameter LP pipe (pry pipe apart to lift valve out).	4.7 (1.1)	3.3 (1.1)	4.1 (1.1)	3.4 (1.0)	3.6 (1.3)	3.2 (1.4)	4.3 (1.1)	3.5 (1.3)	4.5 (0.8)	4.3 (1.2)	4.9 (0.8)
2. Clamp 3' length of 5" pipe in pipe bender and bend to desired degree.	3.3 (1.0)	2.2 (0.8)	3.0 (1.1)	2.1 (1.1)	3.2 (1.2)	2.3 (0.9)	2.8 (1.2)	2.5 (1.2)	3.4 (1.2)	2.8 (1.3)	3.5 (0.7)
3. Braze new 3" flange onto old pipe.	2.0 (0.7)	1.4 (0.5)	2.4 (1.1)	1.6 (0.8)	1.8 (0.6)	1.6 (0.6)	2.1 (1.0)	1.8 (0.9)	3.0 (1.1)	2.5 (1.3)	2.9 (0.8)
4. Use plate shear to cut 5/8" plate 4' x 7'.	4.8 (1.6)	3.3 (1.5)	4.2 (1.2)	3.1 (1.3)	3.6 (1.1)	3.3 (1.4)	3.4 (1.4)	2.9 (1.3)	3.2 (1.4)	2.8 (1.1)	4.5 (1.6)
5. Carry Argon gas bottle to welding area (2 people).	4.5 (1.0)	3.8 (1.0)	3.8 (1.0)	3.5 (1.0)	3.6 (0.8)	3.3 (0.9)	4.0 (1.2)	3.5 (1.0)	3.6 (1.4)	3.9 (1.3)	4.4 (0.8)
6. Fabricate new duct using old duct as a pattern.	2.7 (1.2)	1.7 (0.8)	2.1 (0.9)	1.9 (1.0)	2.2 (0.6)	1.6 (0.6)	2.3 (0.8)	1.9 (0.8)	2.6 (0.9)	2.1 (0.8)	2.8 (0.5)
7. Bring electric welding lead from stowage to patch a 1' x 2' hold in hull.	3.4 (1.0)	2.8 (1.2)	3.1 (0.6)	3.0 (0.9)	3.1 (0.8)	2.5 (1.1)	3.0 (1.3)	2.7 (1.0)	2.7 (1.2)	2.7 (0.9)	3.4 (0.9)
8. Patch a hold in the outer skin of a submarine.	4.5 (1.4)	2.9 (1.4)	4.1 (1.1)	3.9 (1.4)	3.1 (1.4)	2.4 (1.4)	3.9 (1.4)	3.5 (1.9)	4.8 (1.0)	3.6 (1.4)	4.8 (1.2)
9. Clean drains.	2.7 (1.0)	1.6 (0.7)	2.4 (0.9)	2.1 (0.9)	2.6 (0.8)	1.7 (1.0)	2.4 (1.0)	1.9 (0.7)	2.7 (0.8)	2.3 (1.0)	2.9 (0.7)
10. Arc weld a 3" section of low pressure 3" pipe into position in place of the removed damaged piece.	3.2 (0.9)	2.3 (0.9)	3.3 (1.2)	2.7 (1.3)	2.4 (1.1)	2.3 (1.2)	2.9 (0.9)	2.4 (0.9)	4.0 (0.9)	4.0 (1.1)	3.7 (0.9)
11. Rig torch, oxygen and acetylene to weld.	1.6 (1.0)	1.4 (0.6)	1.8 (1.0)	1.6 (0.9)	1.9 (0.9)	1.7 (1.0)	1.8 (1.1)	1.5 (0.8)	2.2 (1.1)	2.0 (1.1)	2.2 (0.8)
12. Fight Class Charlie fire.	4.2 (1.2)	3.4 (1.6)	3.2 (1.4)	3.1 (1.4)	2.8 (1.3)	2.7 (1.5)	3.2 (1.7)	3.1 (1.4)	3.4 (1.5)	3.4 (1.6)	3.9 (1.2)
13. Bring overhaul gear to area (oxygen, rake, shovel, etc.) when fighting a Class Alpha fire.	3.3 (1.1)	2.7 (1.0)	2.7 (0.8)	2.6 (0.8)	2.4 (1.0)	2.5 (1.0)	2.5 (0.8)	2.4 (1.0)	2.5 (1.2)	2.5 (0.9)	3.2 (0.9)
14. Rig hoses below deck - 1½" hose to fight a Class Alpha fire.	3.3 (1.5)	3.0 (1.1)	3.1 (1.1)	2.8 (1.2)	2.8 (0.9)	2.8 (1.3)	3.1 (1.2)	3.1 (1.3)	3.3 (1.1)	3.1 (1.2)	3.8 (1.0)
15. Take P-250 Pump (147#) down one deck to flooded area (2 people).	5.8 (0.9)	4.9 (1.2)	4.6 (1.1)	4.5 (1.2)	4.3 (1.3)	4.2 (1.4)	5.2 (1.1)	4.3 (0.8)	4.3 (1.4)	4.9 (1.2)	5.2 (0.9)
16. Start engine on P-250 Pump.	2.6 (0.9)	1.7 (0.7)	2.6 (1.3)	1.9 (0.9)	3.5 (1.3)	2.0 (1.1)	2.6 (1.1)	2.3 (1.0)	3.0 (1.5)	2.4 (1.1)	3.0 (1.1)

TABLE G-5 INCUMBENT HULL TECHNICIANS' MEAN TASK RATINGS BY ABILITIES AND EFFORT (continued)

	UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
17. Control ruptured LP pipeline.	2.9 (1.2)	2.1 (1.0)	2.9 (1.3)	2.3 (1.1)	2.6 (1.4)	2.2 (1.1)	2.4 (1.0)	2.5 (1.1)	3.3 (1.5)	2.6 (1.2)	3.3 (1.3)
18. Obtain appropriate fire extinguisher and/or hose and begin to fight Class Alpha fire.	3.7 (1.4)	3.2 (1.3)	3.6 (1.1)	3.2 (1.3)	3.1 (1.3)	2.9 (1.5)	3.0 (1.6)	3.0 (1.5)	3.1 (1.2)	3.4 (1.4)	3.8 (1.4)
19. Open and close non-counter balanced scuttles in the overhead.	3.2 (1.1)	2.5 (0.8)	3.1 (1.1)	2.3 (1.1)	3.2 (1.3)	2.2 (1.1)	2.5 (1.0)	2.2 (1.0)	3.2 (0.9)	3.1 (1.0)	3.2 (0.9)
20. Pass boxes of small arms and ammo down two decks.	3.8 (0.7)	2.9 (0.7)	4.1 (1.2)	2.8 (1.2)	3.4 (1.4)	2.2 (1.0)	3.3 (1.1)	3.3 (1.0)	3.4 (1.0)	3.3 (1.4)	3.9 (1.1)
21. During VERTREP, assemble 6-8 pallets, nets, and retrograde on drop zone for return to UNREP ship.	4.4 (1.1)	3.4 (1.1)	4.2 (0.9)	3.1 (1.0)	3.6 (1.5)	2.9 (1.0)	3.3 (1.1)	3.5 (1.0)	3.3 (1.0)	3.0 (1.1)	4.1 (0.8)
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefers).	4.1 (1.4)	3.3 (1.3)	4.2 (1.1)	3.2 (1.1)	3.5 (1.5)	2.6 (1.1)	3.5 (1.1)	3.7 (1.0)	3.6 (1.2)	3.5 (1.1)	4.4 (0.9)
23. Load projectiles for a 5" - 54 gun.	4.8 (1.0)	4.0 (1.4)	5.0 (1.4)	3.7 (1.4)	4.7 (1.6)	4.0 (1.4)	3.8 (1.7)	4.0 (1.5)	3.0 (0.9)	4.7 (1.0)	5.3 (1.0)



TABLE G-6 JOB ANALYSTS' MEAN RATINGS OF HULL TECHNICIAN TASKS BY ABILITIES AND EFFORT

	UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
1. Remove and replace an overhead valve for 4" diameter LP pipe (pry pipe apart to lift valve out).	5.3 (0.6)	3.0 (0.0)	4.0 (0.0)	3.0 (0.0)	3.3 (0.6)	2.3 (0.6)	4.0 (0.0)	2.3 (0.6)	3.3 (1.2)	3.7 (0.6)	4.0 (1.0)
2. Clamp 3' length of 5" pipe in pipe bender and bend to desired degree.	6.0 (0.0)	4.3 (0.6)	3.3 (0.6)	2.7 (1.2)	3.0 (1.0)	2.0 (0.0)	5.3 (0.6)	2.7 (0.6)	2.0 (0.0)	2.0 (0.0)	4.7 (0.6)
3. Braze new 3" flange onto old pipe.	2.7 (0.6)	2.0 (0.0)	2.0 (1.0)	1.7 (0.6)	1.7 (1.2)	1.7 (1.2)	2.3 (0.6)	1.7 (1.2)	2.7 (0.6)	3.3 (0.6)	2.3 (0.6)
4. Use plate shear to cut 5/8" plate 4' x 7'.	5.0 (1.0)	4.3 (0.6)	3.0 (1.0)	2.0 (0.0)	2.0 (0.0)	2.0 (0.0)	4.7 (0.6)	2.0 (1.0)	2.7 (1.2)	2.3 (0.6)	4.7 (0.6)
5. Carry Argon gas bottle to welding area (2 people).	6.0 (0.0)	4.7 (0.6)	5.3 (1.2)	5.3 (1.2)	2.0 (1.0)	2.0 (1.0)	5.0 (1.0)	3.7 (1.5)	3.0 (1.0)	4.0 (0.0)	5.0 (1.0)
6. Fabricate new duct using old duct as a pattern.	4.3 (0.6)	2.7 (1.2)	3.0 (1.0)	2.0 (1.0)	2.0 (1.0)	1.7 (0.6)	3.3 (0.6)	1.7 (0.6)	2.3 (0.6)	1.7 (0.6)	3.0 (0.0)
7. Bring electric welding lead from stowage to patch a 1' x 2' hold in hull.	2.7 (0.6)	2.0 (0.0)	2.3 (0.6)	2.3 (0.6)	1.3 (0.6)	1.7 (0.6)	2.3 (0.6)	1.7 (0.6)	3.0 (1.0)	2.3 (1.5)	2.0 (0.0)
8. Patch a hold in the outer skin of a submarine.	4.0 (1.0)	2.7 (0.6)	4.7 (0.6)	3.0 (0.0)	1.7 (0.6)	1.3 (0.6)	3.7 (1.2)	4.0 (1.0)	3.7 (0.6)	4.0 (0.0)	4.3 (0.6)
9. Clean drains.	2.7 (0.6)	2.0 (0.0)	3.0 (1.0)	2.0 (0.0)	3.0 (0.0)	1.7 (0.6)	2.3 (0.6)	2.3 (0.6)	1.7 (0.6)	1.7 (0.6)	2.7 (0.6)
10. Arc weld a 3" section of low pressure 3" pipe into position in place of the removed damaged piece.	3.0 (1.0)	2.0 (0.0)	4.3 (0.6)	2.0 (0.0)	1.3 (0.6)	1.3 (0.6)	3.0 (1.0)	2.3 (0.6)	3.0 (1.0)	2.3 (0.6)	3.3 (0.6)
11. Rig torch, oxygen and acetylene to weld.	2.3 (0.6)	2.0 (0.0)	2.7 (0.6)	1.7 (0.6)	1.3 (0.6)	1.7 (0.6)	1.7 (0.6)	1.0 (0.0)	3.0 (1.0)	3.0 (1.0)	2.7 (0.6)
12. Fight Class Charlie fire.	4.0 (0.0)	3.0 (0.0)	4.0 (0.0)	3.0 (1.0)	2.0 (0.0)	2.0 (1.0)	3.0 (0.0)	2.3 (0.6)	2.0 (0.0)	3.0 (0.0)	3.7 (0.6)
13. Bring overhaul gear to area (oxygen, rake, shovel, etc.) when fighting a Class Alpha fire.	3.0 (1.0)	2.0 (0.0)	2.7 (0.6)	2.3 (0.6)	1.7 (0.6)	1.7 (0.6)	2.7 (0.6)	2.0 (0.0)	2.0 (0.0)	2.3 (0.6)	2.7 (0.6)
14. Rig hoses below deck - 1 1/2" hose to fight a Class Alpha fire.	4.0 (1.0)	3.3 (0.6)	4.0 (1.0)	3.0 (0.0)	2.3 (0.6)	2.0 (1.0)	3.7 (0.6)	3.0 (0.0)	2.3 (0.6)	2.7 (0.6)	4.0 (1.0)
15. Take P-250 Pump (147#) down one deck to flooded area (2 people).	6.0 (0.0)	5.3 (0.6)	4.7 (1.5)	4.7 (1.5)	2.0 (1.7)	2.3 (1.5)	5.3 (1.2)	3.3 (1.2)	2.0 (0.0)	4.7 (0.6)	5.7 (0.6)
16. Start engine on P-250 Pump.	3.3 (1.5)	2.7 (0.6)	2.7 (1.5)	2.3 (1.2)	5.7 (0.6)	2.7 (2.1)	3.0 (1.0)	1.7 (1.2)	2.3 (0.6)	2.3 (0.6)	4.7 (0.6)

TABLE G-6 JOB ANALYSTS' MEAN RATINGS OF HULL TECHNICIAN TASKS BY ABILITIES AND EFFORT (continued)

	LBSS	LBDS	LBES	TS	S	FLEX	EQ	EFF
17. Control ruptured LP pipeline.	3.0 (1.0)	2.0 (0.0)	2.3 (1.5)	2.3 (0.6)	1.7 (1.2)	2.3 (1.2)	3.7 (0.6)	2.7 (0.6)
18. Obtain appropriate fire extinguisher and/or hose and begin to fight Class Alpha fire.	5.3 (0.6)	5.3 (0.6)	3.0 (0.0)	3.3 (0.6)	3.3 (0.6)	2.7 (0.6)	4.3 (0.6)	4.7 (0.6)
19. Open and close non-counter balanced scuttles in the overhead.	4.7 (0.6)	2.7 (0.6)	2.7 (0.6)	2.7 (0.6)	2.0 (1.0)	2.3 (0.6)	4.7 (0.6)	3.3 (0.6)
20. Pass boxes of small arms and ammo down two decks.	7.0 (0.0)	6.3 (0.6)	1.7 (0.6)	6.0 (0.0)	3.7 (1.2)	3.0 (1.0)	5.3 (0.6)	6.0 (0.0)
21. During VERTREP, assemble 6-8 pallets, nets, and retrograde on drop zone for return to UNREP ship.	3.3 (0.6)	2.3 (0.0)	2.3 (1.5)	3.0 (0.0)	2.0 (1.0)	2.3 (0.6)	2.7 (0.6)	3.0 (0.0)
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefers).	5.0 (0.0)	5.0 (0.0)	2.3 (0.6)	4.0 (1.0)	4.7 (0.6)	3.0 (0.0)	4.0 (1.0)	5.0 (0.0)
23. Load projectiles for a 5" - 54 gun.	6.3 (0.6)	6.0 (0.0)	2.7 (0.6)	5.7 (0.6)	4.0 (1.0)	3.0 (1.0)	3.7 (1.2)	6.0 (0.0)

TABLE G-7 INCUMBENT MACHINIST'S MATES' MEAN TASK RATINGS BY ABILITIES AND EFFORT

	UBSS	LBSS	UBIS	LBIS	UBES	LBES	TS	S	FLEX	EQ	EFF
	3.6 (0.9)	2.8 (0.9)	3.2 (0.6)	2.6 (1.0)	3.1 (1.0)	2.4 (1.1)	2.8 (1.3)	2.5 (1.1)	3.2 (1.0)	3.4 (0.7)	3.6 (0.8)
	4.3 (1.0)	2.8 (1.3)	4.0 (1.2)	2.8 (0.8)	4.1 (1.3)	2.3 (1.3)	3.2 (1.1)	3.1 (0.8)	3.6 (0.9)	3.6 (1.0)	4.2 (1.0)
	3.3 (0.9)	2.6 (1.3)	3.2 (1.0)	2.5 (0.7)	2.4 (0.9)	2.2 (1.1)	3.0 (1.0)	2.2 (1.1)	2.3 (0.8)	2.8 (0.9)	3.5 (0.9)
	2.8 (1.0)	2.5 (2.7)	2.7 (0.8)	2.8 (1.0)	2.2 (1.1)	2.2 (0.8)	3.2 (0.9)	2.3 (0.9)	4.1 (1.0)	3.5 (1.2)	3.2 (0.7)
	3.7 (1.3)	2.5 (1.3)	3.3 (1.0)	2.4 (1.0)	2.5 (1.1)	1.8 (0.7)	3.0 (0.9)	2.2 (1.2)	3.2 (1.2)	2.7 (1.0)	3.2 (0.8)
	2.3 (1.3)	1.5 (0.7)	1.9 (1.0)	1.3 (0.5)	2.0 (0.9)	1.5 (0.9)	1.7 (1.0)	1.5 (0.8)	2.1 (1.0)	1.8 (0.9)	1.9 (0.8)
	4.5 (1.0)	3.9 (1.0)	4.2 (0.7)	3.7 (1.4)	3.5 (1.3)	3.8 (1.2)	4.1 (1.5)	3.3 (0.9)	3.8 (1.0)	3.7 (1.1)	4.5 (1.0)
	4.5 (0.9)	3.9 (1.2)	4.2 (0.7)	3.8 (1.3)	3.3 (1.0)	3.6 (1.2)	4.2 (1.5)	3.3 (0.9)	3.9 (1.0)	3.8 (1.2)	4.6 (1.0)
	5.5 (1.0)	5.1 (1.4)	4.9 (1.0)	4.6 (1.5)	4.3 (1.0)	3.9 (0.8)	4.5 (1.1)	3.9 (0.9)	3.8 (1.3)	4.2 (0.9)	5.3 (0.9)
	2.8 (1.4)	1.9 (0.9)	2.4 (1.0)	1.6 (0.7)	1.8 (0.7)	1.9 (0.9)	2.1 (1.0)	1.8 (1.2)	2.3 (1.5)	1.6 (0.7)	2.8 (0.9)
	4.3 (1.0)	3.2 (0.9)	3.6 (1.0)	2.8 (1.2)	3.2 (1.1)	2.8 (1.0)	3.1 (0.9)	2.7 (0.9)	3.3 (1.1)	2.7 (1.1)	4.0 (0.6)
	4.2 (2.0)	4.1 (1.8)	3.8 (1.3)	3.7 (1.7)	3.5 (1.6)	3.6 (1.6)	3.8 (1.6)	3.2 (1.6)	3.0 (1.6)	3.4 (1.4)	4.0 (1.7)
	5.5 (1.1)	4.9 (1.3)	5.0 (0.8)	4.6 (1.4)	4.3 (1.3)	3.9 (1.3)	5.0 (1.2)	3.8 (1.0)	3.9 (1.3)	4.0 (1.0)	5.4 (1.0)
	4.5 (1.4)	4.0 (1.7)	3.9 (1.0)	3.4 (1.4)	3.5 (1.1)	3.1 (1.3)	3.6 (1.3)	3.0 (1.3)	3.7 (1.2)	3.0 (1.4)	4.2 (1.0)
	4.5 (1.6)	3.9 (1.5)	3.8 (1.7)	3.5 (1.4)	3.3 (1.5)	3.3 (1.5)	3.8 (1.5)	3.1 (1.8)	3.6 (1.0)	3.7 (1.2)	4.2 (1.7)
	2.7 (1.0)	2.5 (0.9)	2.8 (0.8)	2.5 (1.2)	2.2 (0.9)	2.3 (0.9)	2.8 (1.1)	2.3 (1.2)	2.2 (0.9)	2.6 (1.0)	3.0 (0.8)

• Replace defective relief valve in the overhead.

1. Unbolt valve from flanges using appropriate tools.

2. Use slugging wrench if necessary.

3. Lower valve to deck, using come-along or chainfall.

• Remove auxiliary circulating pump from underneath evaporator.

4. Crawl under evaporator with hand tools.

5. Make necessary repairs, replace bearing and wearing rings, and perform PMS.

6. Roll/rotate pump by hand.

• General Tasks.

7. Remove main drain valve from bilges (150#).

8. Replace main drain valve into bilge.

9. Replace 48" flywheel on HP air compressor.

10. Install new gaskets and "O" rings on HP air compressor.

11. Perform PMS on air ejector.

12. Receive auxiliary circulating pump in shop (or on tender).

12. Rig and remove upper half of spring bearing on main shaft.

14. Remove interference as necessary (e.g., deck plates, etc.) to replace line shaft bearing.

15. Remove convection heaters and pressure test.

16. Carry tool bag (35#)

TABLE 6-7 INCUMBENT MACHINIST'S MATES' MEAN TASK RATINGS BY ABILITIES AND EFFORT (continued)

	UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
17. Carry 5 gallon cans of freon to large air conditioning unit (2 people, 150#).	3.8 (0.8)	3.8 (1.1)	4.1 (1.1)	3.7 (1.4)	3.4 (1.2)	3.4 (1.2)	3.5 (1.3)	3.3 (0.9)	2.7 (1.0)	3.6 (1.0)	4.0 (0.9)
18. Obtain appropriate fire extinguisher and/or hose and begin to fight a Class Alpha fire.	3.9 (1.3)	3.1 (1.0)	3.7 (1.3)	3.3 (1.3)	3.2 (1.2)	3.2 (1.5)	3.2 (1.1)	3.4 (1.2)	3.4 (1.0)	3.4 (1.3)	4.0 (0.9)
19. Open and close non-counter balanced scuttles in the overload.	3.5 (1.1)	2.8 (1.1)	3.3 (0.9)	2.9 (1.1)	3.1 (0.9)	2.8 (1.2)	2.8 (1.1)	2.1 (1.1)	3.0 (1.0)	2.9 (0.9)	3.7 (1.2)
20. Pass munitions for 5" - 54 guns by hand down two decks to the magazine.	4.9 (1.5)	4.3 (1.3)	5.0 (1.3)	4.0 (1.6)	4.1 (1.2)	3.5 (1.8)	4.5 (1.2)	4.1 (0.8)	3.9 (0.8)	4.2 (1.3)	4.9 (1.1)
21. During VERTREP, assemble 6-8 pallets, nets, and retrograde on drop zone for return to UNREP ship.	4.1 (1.0)	4.4 (1.4)	3.9 (0.8)	3.6 (0.9)	3.4 (1.5)	3.0 (1.1)	4.0 (1.4)	3.4 (1.2)	3.5 (1.2)	3.6 (1.1)	4.5 (1.4)
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefer).	3.9 (1.0)	3.5 (1.0)	4.2 (1.2)	3.6 (1.1)	3.6 (1.2)	3.2 (1.3)	4.0 (1.2)	3.6 (1.0)	3.7 (0.9)	3.7 (1.3)	4.2 (1.1)
23. Load projectiles for a 5" - 54 gur.	5.1 (1.6)	4.6 (1.4)	5.0 (1.0)	4.7 (1.5)	3.9 (1.3)	4.0 (1.8)	4.3 (1.1)	4.1 (0.7)	4.0 (1.5)	4.1 (1.3)	4.7 (1.1)

TABLE G-8 JOB ANALYSTS' MEAN RATINGS OF MACHINIST'S MATE TASKS BY ABILITIES AND EFFORT

UNSS	LBSS	UBUS	LBUS	UBES	LBES	YS	S	FLEX	EQ	EFF
4.7 (0.6)	3.0 (1.0)	3.7 (1.5)	2.7 (0.6)	3.0 (1.0)	2.0 (0.0)	3.0 (1.7)	1.7 (0.6)	3.3 (0.6)	4.0 (1.0)	4.0 (1.0)
3.7 (0.6)	2.7 (0.6)	4.7 (1.2)	2.7 (0.6)	4.0 (0.0)	2.3 (0.6)	2.7 (1.5)	2.0 (0.0)	3.3 (0.6)	3.7 (1.5)	4.0 (1.0)
4.7 (0.6)	3.3 (0.6)	4.3 (1.2)	3.0 (0.0)	3.0 (1.0)	2.7 (0.6)	4.3 (0.6)	2.7 (0.6)	3.3 (0.6)	3.3 (1.5)	4.0 (0.0)
2.0 (0.0)	2.3 (0.6)	2.3 (0.6)	2.7 (0.6)	1.7 (0.6)	1.7 (0.6)	3.3 (0.6)	2.0 (0.0)	5.0 (0.0)	2.7 (1.2)	3.0 (0.0)
2.7 (0.6)	1.7 (0.6)	2.3 (0.6)	1.7 (0.6)	2.3 (0.6)	1.7 (0.6)	2.3 (1.2)	1.3 (0.6)	1.7 (0.6)	2.0 (0.0)	2.3 (0.6)
2.7 (0.6)	1.7 (0.6)	2.3 (0.6)	1.7 (0.6)	1.3 (0.6)	1.0 (0.0)	2.3 (0.6)	1.3 (0.6)	2.3 (1.2)	2.0 (1.0)	2.0 (0.0)
5.3 (0.6)	4.0 (1.0)	4.3 (1.5)	3.0 (1.0)	3.3 (1.2)	2.7 (1.2)	5.0 (0.0)	3.3 (1.5)	3.7 (0.6)	3.3 (1.5)	5.0 (1.0)
5.3 (0.6)	4.0 (1.0)	4.3 (0.6)	3.3 (0.6)	2.7 (1.2)	2.7 (1.2)	5.0 (0.0)	3.0 (1.7)	3.3 (0.6)	3.3 (0.6)	4.7 (0.6)
4.7 (0.6)	3.3 (0.6)	4.0 (1.0)	3.7 (0.6)	2.7 (0.6)	2.7 (0.6)	3.7 (0.6)	2.7 (1.5)	5.0 (0.0)	4.0 (0.0)	4.0 (0.0)
3.3 (0.6)	3.0 (0.0)	2.7 (1.2)	2.3 (0.6)	2.0 (0.0)	2.0 (0.0)	2.7 (1.5)	1.3 (0.6)	2.0 (0.0)	2.0 (0.0)	3.0 (1.0)
4.3 (0.6)	3.0 (0.0)	5.0 (0.0)	3.0 (0.0)	2.7 (0.6)	2.3 (0.6)	4.0 (0.0)	2.3 (0.6)	3.3 (0.6)	3.3 (0.5)	4.0 (0.0)
5.3 (0.6)	4.0 (1.7)	5.0 (1.0)	4.0 (1.7)	2.7 (0.6)	2.7 (0.6)	4.7 (1.2)	3.0 (1.0)	2.7 (0.6)	3.0 (1.0)	4.7 (1.2)
4.7 (0.6)	3.3 (0.6)	4.3 (0.6)	3.0 (0.0)	2.7 (0.6)	2.3 (0.6)	4.0 (0.0)	2.7 (1.2)	4.0 (1.0)	3.3 (1.2)	4.0 (0.0)
5.3 (0.6)	4.3 (1.2)	5.0 (1.0)	4.0 (1.0)	2.7 (0.6)	2.7 (0.6)	4.3 (1.2)	3.3 (1.2)	3.7 (0.6)	3.7 (1.5)	5.0 (1.0)
4.0 (0.0)	3.0 (0.0)	2.7 (0.6)	2.3 (0.6)	1.7 (0.6)	1.3 (0.6)	3.3 (1.2)	1.3 (0.6)	2.3 (0.6)	2.3 (0.6)	3.0 (0.0)
4.3 (0.6)	2.7 (0.6)	3.7 (1.2)	3.0 (1.0)	2.0 (0.0)	2.0 (0.0)	3.0 (1.0)	2.0 (0.0)	1.3 (0.6)	2.3 (0.6)	3.7 (1.2)

- Replace defective relief valve in the overhead.

1. Unbolt valve from flanges using appropriate tools.

2. Use slugging wrench if necessary.

3. Lower valve to deck, using come-along or chainfall.

- Remove auxiliary circulating pump from underneath evaporator.

4. Crawl under evaporator with hand tools.

5. Make necessary repairs, replace bearing and wearing rings, and perform PMS.

6. Roll/rotate pump by hand.

- General Tasks.

7. Remove main drain valve from bilges (150#).

8. Replace main drain valve into bilge.

9. Replace 48" flywheel on HP air compressor.

10. Install new gaskets and "O" rings on HP air compressor.

11. Perform PMS on air ejector.

12. Receive auxiliary circulating pump in shop (or on tender).

13. Rig and remove upper half of spring bearing on main shaft.

14. Remove interference as necessary (e.g., deck plates, etc.) to replace line shaft bearing.

15. Remove convection heaters and pressure test.

16. Carry tool bag (35#)

TABLE G-8 JOB ANALYSTS' MEAN RATINGS OF MACHINIST'S MATE TASKS BY ABILITIES AND EFFORT (continued)

	UBSS	LBSS	UBUS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
17. Carry 5 gallon cans of freon to large air conditioning unit (2 people, 150#).	5.3 (0.6)	4.3 (1.2)	5.0 (1.0)	4.7 (1.5)	2.3 (0.6)	1.7 (0.6)	4.7 (1.2)	3.0 (1.0)	2.3 (0.6)	4.0 (1.0)	5.3 (0.6)
18. Obtain appropriate fire extinguisher and/or hose and begin to fight a Class Alpha fire.	5.3 (0.6)	3.7 (0.6)	5.3 (0.6)	3.7 (0.6)	3.0 (0.0)	2.3 (0.6)	3.3 (0.6)	3.3 (0.6)	2.7 (0.6)	4.3 (0.6)	4.7 (0.6)
19. Open and close non-counter balanced scuttles in the overload.	4.7 (0.6)	2.7 (0.6)	3.3 (0.6)	2.7 (0.6)	2.7 (0.6)	2.0 (1.0)	2.7 (0.6)	2.0 (1.0)	2.3 (0.6)	4.7 (0.6)	3.3 (0.6)
20. Pass munitions for 5" - 54 guns by hand down two decks to the magazine.	7.0 (0.0)	5.7 (0.6)	5.3 (0.6)	6.0 (1.0)	1.7 (0.6)	1.7 (0.6)	6.0 (0.0)	3.7 (1.2)	3.0 (1.0)	5.3 (0.6)	6.0 (0.0)
21. During VERTREP, assemble 6-8 pallets, nets, and retrograde on drop zone for return to UNREP ship.	3.3 (0.6)	2.3 (0.6)	3.0 (0.0)	2.3 (0.6)	2.3 (1.5)	1.3 (0.6)	3.0 (0.0)	2.0 (1.0)	2.3 (0.6)	2.7 (0.6)	3.0 (0.0)
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefer).	5.0 (0.0)	3.7 (0.6)	5.0 (0.0)	4.3 (0.6)	2.3 (0.6)	2.0 (0.0)	4.0 (1.0)	4.7 (0.6)	3.0 (0.0)	4.0 (1.0)	5.0 (0.0)
23. Load projectiles for a 5" - 54 gun.	6.3 (0.6)	6.0 (0.0)	6.0 (0.0)	5.3 (1.2)	2.7 (0.6)	1.7 (0.6)	5.7 (0.6)	4.0 (1.0)	3.0 (1.0)	3.7 (1.2)	6.0 (0.0)

TABLE G-9. JOB ANALYSTS' CONSENSUS RATINGS OF BOATSWAIN'S MATE TASK BY ABILITIES AND EFFORT

LBSS	UBSS	LBUS	LBUS	UBES	LBES	TS	S	FLEX	EQ	EFF
5	4	4	3	2	2	5	2	2	3	5
9	9	9	9	9	9	9	9	9	9	9
9	9	9	9	9	9	9	9	9	9	9
9	9	9	9	9	9	9	9	9	9	9
9	9	9	9	9	9	9	9	9	9	9
3	2	1	1	2	1	2	1	2	2	2
3	2	3	2	2	2	2	2	2	2	3
9	9	9	9	9	9	9	9	9	9	9
5	4	5	3	3	2	5	4	3	5	5
4	2	4	1	3	1	4	3	3	3	4
2	1	4	1	1	1	2	2	3	3	3
6	4	3	2	2	1	4	2	3	3	5
4	3	4	2	2	2	3	2	1	2	3
2	1	2	1	3	1	3	1	5	4	3
4	2	3	2	4	2	4	2	4	4	4
5	3	4	3	2	2	4	2	2	3	4

• Stream probe refueling to a destroyer.

1. Breakout tool box.
2. Fifteen people pull messenger phone lines and span wire on board.
3. Connect span wire to fixed padeye with pelican hook.
4. Give hard pull for last several feet so that probe seats into probe receiver.
5. Rig easing out line.

• Getting underway.

6. Remove mooring lines by flipping off of the bollard (2 people).
7. Haul mooring line back aboard ship with 6 people.

• General tasks.

8. During an UNREP release slings from cargo drop reel to allow for its return to the delivery ship.
9. One person load 15 5-gallon cans of paint into storage bins.
10. Rig boatswain chair and hoist seaman aloft.
11. Chip paint with pneumatic tool (e.g., deck crawler, knuckle buster, needle gun) for two hours.
12. Rig chainfall to fixed padeye for removing compressor from a walk-in refrigerator.
13. Pull/slack mooring line from ship to pier by hand (2 people).
14. Rig SAV-ALL safety net under brow.
15. Bolt (narry) causeways together.
16. After performing PMS on anchor chain, replace chain to appropriate position in chain locker.

TABLE G-9. JOB ANALYSTS' CONSENSUS RATINGS OF BOATSWAIN'S MATE TASK BY ABILITIES AND EFFORT (continued)

UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
4	3	5	2	3	2	4	4	2	4	4
5	4	5	4	3	3	3	4	3	4	5
5	3	3	3	3	1	2	2	3	4	4
7	6	6	5	2	2	6	3	3	5	6
3	2	3	2	3	1	3	2	2	3	3
5	4	5	4	2	2	4	5	3	3	5
6	5	6	4	3	2	6	4	3	3	6

17. Serve as first loader on 3" - 50 gun.
18. Obtain appropriate fire extinguisher and/or hose and begin to fight a Class Alpha fire.
19. Open and close non-counter balanced scuttles in the overhead.
20. Breakout ammo from magazine and take up two decks to ready service locker.
21. During VERTREP, assemble 6-8 pallets, nets and retrograde on drop zone for return to UNREP ship.
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefers).
23. Serve as projectile loader on 5" - 54 gun.



TABLE G-10. JOB ANALYSTS' CONSENSUS RATINGS OF GUNNER'S MATE TASK BY ABILITIES AND EFFORT

URSS	LBSS	UBUS	LBUS	UBES	LBES	TS	S	FLEX	EQ	EFF
1	2	1	1	1	1	2	1	3	2	2
6	4	4	3	1	1	5	2	2	3	5
5	4	3	2	1	1	4	2	2	3	4
3	2	3	2	1	1	3	2	2	3	3
3	1	2	1	3	1	2	2	2	2	3
4	3	3	2	2	2	3	2	2	3	4
5	3	3	2	2	2	4	2	3	2	4
1	1	1	1	1	1	2	1	2	2	1
5	3	3	3	2	2	3	2	2	2	4
4	3	5	2	3	2	4	4	2	4	4
2	2	2	2	1	1	2	1	2	2	2
6	4	5	4	2	2	5	4	3	4	6
6	5	6	4	2	2	5	3	4	4	6
3	2	3	2	2	2	2	2	2	3	3
2	1	2	1	2	1	2	1	3	2	1
4	3	3	3	2	2	3	2	2	3	4

- PMS on breech block (175#) 3" - 50 gun.
- 1. Crawl into appropriate area to perform PMS.
- 2. Second GM reaches in and removes block from first GM.
- 3. Replace breech block on 3" - 50 gun by having one GM attach winch, lower block to other GM.
- During VERTREP.
- 4. Lay out cargo nets for receiving pallets from forklift.
- 5. Cut banding from pallets
- General tasks.
- 6. Remove loader driver motor for PMS.
- 7. Release counter recoil spring on 3" - 50 gun.
- 8. Check and make fine adjustments on 3" power drive.
- 9. Load 5" mortar with rapid blooming off-board chaff.
- 10. Load 3" - 50 gun during combat/gun shoot.
- 11. Use ammo hoist to lower munitions for 5" - 54 gun to magazine deck.
- 12. Carry munitions for 5" - 54 gun from stowage area across deck to ladder.
- 13. Place projectiles for 5" - 54 gun in racks.
- 14. Plug a small hole in the bulkhead with a piece of soft wood.
- 15. Repair and adjust components of the control panels (e.g., circuit breakers, etc.).
- 16. To patch large hole in bulkhead, shore up the deck from the next lower deck.

TABLE G-10. JOB ANALYSTS' CONSENSUS RATINGS OF GUNNER'S MATE TASK BY ABILITIES AND EFFORT (continued)

UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
3	2	4	2	2	2	2	1	3	4	3
5	4	5	4	3	3	3	4	3	4	5
5	3	3	3	3	1	2	2	3	4	4
7	6	6	5	2	2	6	3	3	5	6
3	2	3	2	3	1	3	2	2	3	3
5	4	5	4	2	2	4	5	3	3	5
6	5	6	4	3	2	6	4	3	3	6

17. Control ruptured LP pipeline.

18. Obtain appropriate fire extinguisher and begin to fight Class Alpha fire.

19. Open and close non-counter balanced scuttles in the overhead.

20. Pass boxes of small arms ammo down two decks (2 people).

21. During VERTREP, assemble 6-8 pallets, nets, and retrograde on drop zone for return to UNREP ship.

22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefer).

23. Load projectiles for a 5" - 54 gun Mark 42.

TABLE G-11. JOB ANALYSTS' CONSENSUS RATINGS OF HULL TECHNICIAN TASK BY ABILITIES AND EFFORT

UBSS	LBSS	UBUS	LBUS	UBES	LBES	TS	S	FLEX	EQ	EFF
5	3	4	3	4	2	4	4	4	4	4
6	4	3	2	3	2	5	3	2	2	5
3	2	4	2	1	1	2	1	3	4	2
5	4	3	2	2	2	5	2	2	3	4
6	4	6	6	2	2	6	4	4	4	6
4	3	3	2	2	1	3	2	3	2	3
3	2	2	2	1	2	2	2	3	3	2
3	2	5	3	2	1	4	4	4	4	4
3	2	3	2	3	2	2	2	2	2	3
2	2	4	2	1	1	3	2	3	2	3
3	2	3	2	1	2	2	1	3	3	3
4	3	4	3	2	3	3	2	2	3	4
3	2	3	2	2	2	3	2	2	3	3
4	3	4	3	3	3	4	3	2	3	4
6	6	6	5	1	3	6	4	2	5	6
2	2	4	3	6	2	3	2	2	2	5

1. Remove and replace an overhead valve for 4" diameter LP pipe (pry pipe apart to lift valve out).
2. Clamp 3' length of 5" pipe in pipe bender and bend to desired degree.
3. Braze new 3" flange onto old pipe.
4. Use plate shear to cut 5/8" plate 4' x 7'.
5. Carry Argon gas bottle to welding area (2 people).
6. Fabricate new duct using old duct as a pattern.
7. Bring electric welding lead from stowage to patch a 1' x 2' hold in hull.
8. Patch a hold in the outer skin of a submarine.
9. Clean drains.
10. Arc weld a 3" section of low pressure 3" pipe into position in place of the removed damaged piece.
11. Rig torch, oxygen and acetylene to weld.
12. Fight Class Charlie fire.
13. Bring overhaul gear to area (oxygen, rake, shovel, etc.) when fighting a Class Alpha fire.
14. Rig hoses below deck - 1 1/2" hose to fight a Class Alpha fire.
15. Take P-250 Pump (147#) down one deck to flooded area (2 people).
16. Start engine on P-250 Pump.

TABLE G-11. JOB ANALYSTS' CONSENSUS RATINGS OF HULL TECHNICIAN TASK BY ABILITIES AND EFFORT (continued)

	UBSS	LBSS	UBUS	LBUS	UBES	LBES	TS	S	FLEX	EQ	EFF
17. Control ruptured LP pipeline.	3	2	4	2	2	2	2	1	3	4	3
18. Obtain appropriate fire extinguisher and/or hose and begin to fight Class Alpha fire.	5	4	5	4	3	3	3	4	3	4	5
19. Open and close non-counter balanced scuttles in the overhead.	5	3	3	3	3	1	2	2	3	4	4
20. Pass boxes of small arms and ammo down two decks.	7	6	6	5	2	2	6	3	3	5	6
21. During VERTREP, assemble 6-8 pallets, nets, and retrograde on drop zone for return to UNREP ship.	3	2	3	2	3	1	3	2	2	3	6
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefers).	5	4	5	4	2	2	4	5	3	3	5
23. Load projectiles for a 5" - 54 gun.	6	5	6	4	3	2	6	4	3	3	6

TABLE G-12. JOB ANALYSTS' CONSENSUS RATINGS OF MACHINIST'S MATE TASK BY ABILITIES AND EFFORT

UBSS	LBSS	UBUS	LBUS	UBES	LBES	TS	S	FLEX	EQ	EFF
5	3	4	3	3	2	4	2	3	4	4
4	3	4	3	4	2	3	2	3	4	4
4	3	5	3	3	2	4	3	3	3	4
2	2	2	2	1	1	3	2	5	2	3
3	2	2	2	2	2	3	1	2	2	2
3	2	2	2	1	1	2	1	3	2	2
5	4	4	3	4	2	5	3	4	3	5
5	4	4	3	2	2	5	3	3	3	5
5	3	4	3	3	3	4	3	5	4	4
3	3	2	2	2	2	3	1	2	2	3
4	3	5	3	3	2	4	2	3	3	4
5	4	5	3	2	2	5	3	3	4	5
5	3	5	3	3	2	4	2	3	3	4
5	4	5	3	2	2	5	4	3	5	5
4	3	3	2	2	1	3	1	2	3	3
4	3	3	2	2	2	3	1	2	3	3
4	3	3	3	2	2	3	2	1	2	3

- Replace defective relief valve in the overhead.
  1. Unbolt valve from flanges using appropriate tools.
  2. Use slugging wrench if necessary.
  3. Lower valve to deck, using come-along or chainfall.
- Remove auxiliary circulating pump from underneath evaporator.
  4. Crawl under evaporator with hand tools.
  5. Make necessary repairs, replace bearing and wearing rings, and perform PMS.
  6. Roll/rotate pump by hand.
- General Tasks.
  7. Remove main drain valve from bilges (150#).
  8. Replace main drain valve into bilge.
  9. Replace 48" on HP air compressor.
  10. Install new gaskets and "O" rings on HP air compressor.
  11. Perform PMS on air ejector.
  12. Receive auxiliary circulating pump in shop (or on tender).
  13. Rig and remove upper half of spring bearing on main shaft.
  14. Remove interference as necessary (e.g., deck plates, etc.) to replace line shaft bearing.
  15. Remove convection heaters and pressure test.
  16. Carry tool bag (35#)

TABLE G-12. JOB ANALYSTS' CONSENSUS RATINGS OF MACHINIST'S MATE TASK BY ABILITIES AND EFFORT (continued)

UBSS	LBSS	UBDS	LBDS	UBES	LBES	TS	S	FLEX	EQ	EFF
5	4	5	4	2	2	4	2	2	4	5
5	4	5	4	3	3	3	4	3	4	5
5	3	3	3	3	1	2	2	3	4	4
7	6	6	5	2	2	6	3	3	5	6
3	2	3	2	3	1	3	2	2	3	3
5	4	5	4	2	2	4	5	3	3	5
6	5	6	4	3	2	6	4	3	3	6

17. Carry 5 gallon cans of freon to large air conditioning unit (2 people, 150#).
18. Obtain appropriate fire extinguisher and/or hose and begin to fight a Class Alpha fire.
19. Open and close non-counter balanced scuttles in the overload.
20. Pass munitions for 5" - 54 guns by hand down two decks to the magazine.
21. During VERTREP, assemble 6-8 pallets, nets, and retrograde on drop zone for return to UNREP ship.
22. Place stores (e.g., frozen chicken, milk, etc.) in bins (e.g., reefer).
23. Load projectiles for a 5" - 54 gun.